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CHEMICAL ABSTRACTS

Vol. 21.

NOVEMBER 10, 1927

No. 21

1—APPARATUS AND PLANT EQUIPMENT

W. L. BADGER

Some additional refinements for precision balances. J. J. MANLEY. *Proc. Phys. Soc. (London)* 39, 444-8(1927). E. H.

Apparatus for micro-analysis. C. VAN ZIJP. *Pharm. Weekblad* 64, 916-9(1927).—Simple devices are described for filtration, detection of carbonates, sublimation, sepn. of immiscible liquids, extrn. and steam distn. of small quantities of material.

A. W. DOX

A continuous-reading electrotitration apparatus. STEPHEN POPOFF AND J. HILDEBRAND. *Proc. Iowa Acad. Sci.* 33, 172(1926).—An abstract. Goode's single radio-tube electrotitration set up was modified so as to give greater sensitivity. In place of the galvanometer a microammeter reading to 750 microamps is used in the circuit.

W. G. GAESSLER

Simple mercury cathode for arsenic determination. F. S. AUMONIER. *J. Soc. Chem. Ind.* 46, 311-5T(1927).—A describes in detail a porcelain porous cell in which Hg is the cathode and over which arsine is generated by the electrolytic reduction of the As compd. Uniform deposits of As were secured with the app. and it is recommended for pptg. small quantities of As as in foodstuffs. An abstract of Ramberg and Sjöström's wet combustion and HCl-distn. method for detg. As is given.

J. W. SHIPLEY

A convenient form of apparatus for the determination of melting temperature. GEORGE LYNN. *J. Phys. Chem.* 31, 1381-2(1927).—A modification of Washburn's app. (cf. *C. A.* 18, 2823), by the addn. of a heating coil wound upon a glass tube, and a removable sample tube which rests upon glass wool. The heating coil of No. 36 nichrome wire is wrapped about a glass tube in which are punched 3 holes, 2 at the top and 1 at the bottom. The wire is threaded several times through the lower hole to hold the free end in position, and then wrapped about the tube in turns about 2 mm. apart. At one of the upper holes it is attached to a Cu lead. The other free end is brought up inside the tube to the other hole where it is fastened to the second Cu lead.

ROBERT K. WERNER

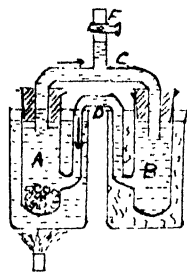
Apparatus for the determination of thermal conductivities of high-temperature insulation. R. H. HEILMAN. *Trans. Am. Inst. Chem. Eng.* 18, 283-93(1926); cf. *C. A.* 21, 1319.—Data are given of an investigation on the development of a flat plate testing device for the accurate detn. of the thermal conductivities of high-temp. insulation and refractory materials. The app. is illus. and described. The cond. of a flat plate is expressed by $K = [W \times 3.415 \times \text{thickness (in.)}] / \text{area (ft.}^2\text{)} (t_1 - t_2)$.

W. H. BOYNTON

Recrystallization. H. DANNEEL. *Chem. App.* 14, 193-4(1927); 2 cuts.—The impure substance is placed in A and the app. filled with the satd. soln. through F. On heating the beaker contg. A and cooling B in ice H₂O, circulation takes place as indicated, the purified substance being crystd. out in B. The app. has a wide application.

J. H. MOORE

Device for detecting traces of mercury vapor (with selenium sulfide). ANON. *Gen. Elec. Rev.* 30, 442(1927).—One part of Hg vapor in 20,000,000 parts of the atm. may be measured accurately by an operation based on a reaction between a solid, Se sulfide, and the vapor, with the reaction product an easily observable colored substance. The darkening depends upon the concn. of Hg vapor, the time of exposure, and other controllable factors. The app. may afford a continuous and automatic record of the Hg content. The photoelec. cell circuit may be arranged to furnish a warning signal when the Hg concn. becomes dangerously high.



W. H. BOYNTON

A new differential dilatometer for the determination of volume changes during solidification. C. J. SMITH. *Proc. Roy. Soc. (London)* **A115**, 554 70(1927).—The Pb-Sn eutectic was found to contract 2.5% and the Bi-Sn eutectic to expand 0.8% on solidifying, by the use of a differential dilatometer so designed that the pressure on the two sides was kept equal by the removal of known amts. of Hg. F. O. A.

The T. C.-B. photo-colorimeter for measuring colors independently of the eye. RENÉ TOUSSAINT. *Bull. soc. encour. ind. nat.* **126**, 421-30(1927).—A given color can be characterized by a curve obtained by plotting the intensity of each shade present (blue, orange, red, yellow, etc.) as compared either with a pure white (e. g., plaster or MgO) or with a standard color. In the T. C.-B. photo-colorimeter the intensity is measured by means of a photo-elec. cell, consisting of a glass bulb filled with A under low pressure and coated inside with K (acting as cathode); inside the bulb is placed a W ring (as anode). Under the action of light, the K cathode emits electrons which make the current vary according to the intensity of the light, and the variations are measured by means of a galvanometer or ammeter. The intensity in the various parts of the spectrum is measured by interposing suitable color screens. The method of measuring and duplicating colors is described, and the chief applications of the instrument are enumerated. A. PAPINEAU-COUTURE

The T. C.-B. photo-colorimeter. J. PYTE. *Tiba* **5**, 955 73(1927); cf. preceding abstr.—A detailed description of the instrument and its operation. A. P.-C.

Machine devised by the Compagnie des Chemins de Fer de l'Est for testing lubricating oils, bronzes and anti-friction alloys. ANON. *Bull. soc. encour. ind. nat.* **126**, 444-9(1927). The machine described has been designed and constructed in such a manner that the material is tested under conditions practically identical with those to which it is subjected in service in rolling stock. A. PAPINEAU-COUTURE

Apparatus for carrying out physical or chemical experiments at all temperatures and under liquid pressures up to 15,000 kilograms per square centimeter. JAMES BASSET. *Compt. rend.* **185**, 343 5(1927).—An app. is described with diagram and photograph, by which regulable pressures up to 20,000 kg. per sq. cm. can be produced. The expt. chamber is provided with insulated electrodes to allow of heating the chamber or of electrolyzing under pressure. Special steels (compn. not given) are used and exceptional care is taken in machining, etc. A. P.-C.

The use of aluminum in the construction of apparatus. W. MEINECKE. *Metall-börse* **16**, 873 4, 929-31, 986 7, *Chem. Zentr.* **1926**, II, 282.—Expts. dealing with the attack of Al sheet by various substances are described. Aktivin has no action, MeOH and EtOH have a slight action when they are in 20% concn. in water; HCO₂H has a slight action; AcOAm has no action; sour beer has practically no action; AcOH acts slowly when cold but vigorously when boiling, KOH has a strong action; PhOH has a weak action which becomes more vigorous when it is heated, MgCl₂ has a slight action; mud-baths and chalybeate baths (Bad Elster) have no action, NaHCO₃ and NaCl solns. have a slight action; Na₂CO₃ soln. has a strong action, petroleum has no action; HNO₃ has the most vigorous action at 70% concn. but when warmed to 60-70° HNO₃ at 60% concn. has the max. action; the action of H₂SO₄ depends upon the concn. of its soln., cold tar has no action, but when hot the phenols which it contains attack the Al vigorously; CCl₄, cellulose pulp and onion juice have no action. C. C. DAVIS

Some mistakes in the construction of evaporators and their correction. BERTHOLD BRÖCK. *Chem. App.* **14**, 112 3, 170 2, 196 8(1927), 23 cuts.—The proper insertion of tube-sheets, arrangement of tubes, steam pipe and H₂O-drain connections, and various body types are shown. J. H. MOORE

Some modern developments in chemical plant. D. L. HOWARD. *Pharm. J.* **118**, 783-7(1927). An illustrated account of modern app. for evapn., sepn. and fine grinding on a mfg. scale. S. WALDBOTT

Experiments on the construction of a polariscope with photoelectric indication. VL. STANEK AND K. ŠANDERA. *Z. Zuckerind. czechoslov. Rep.* **51**, 245 8(1927).—The light is received on a sensitive cell consisting of a vacuum tube with a wire anode and a film of metallic K as cathode. The current so generated is amplified with an ordinary vacuum tube. The method offers possibilities, but as yet has not been made accurate to less than 1° Ventzke. ZD. VYTOPI. *Ibid* **51**, 335 6; VL. STANEK AND K. ŠANDERA. *Ibid* 336. Discussion W. L. BADGER

Stoneware exhaust fans and blowers. P. C. KINGSBURY AND F. E. MEHRHOF. *Trans. Am. Inst. Chem. Eng.* **18**, 103-29(1926).—Expts. were conducted on 4 stoneware exhausters. A brief review of the development of a satisfactory stoneware exhauster is given. Data and the method of calcg. results are tabulated and graphed.

The results for the larger fans are probably correct to within 5%, and those for the 10-cm fan within 10%. W. H. BOYNTON

- Acetylene generator. L. W. STETTNER. U. S. 1,642,467, Sept. 13.
 Heat-exchange apparatus. R. C. JONES. U. S. 1,641,975, Sept. 13.
 Heat-exchange apparatus. H. WEBSTER. U. S. 1,641,999, Sept. 13.
 Viscometer. C. M. LARSON and C. L. KNOPP. Brit. 262,652, May 17, 1926.
 Viscometer. KNOW MILL PRINTING CO., LTD., AND T. L. MORT. Brit. 262,539, Sept. 18, 1925.
 Manometer. W. LOMMEL. U. S. 1,642,615, Sept. 13.
 Filter. G. C. LEWIS. Brit. 262,328, May 11, 1926. A filter for liquids is prepd. by placing activated C or similar material in a ceramic container, burning to render the container porous and render the C more active, and, if desired, adding substances such as KMnO_4 or Cu salts.
 Filter for removing liquid particles and dust from gases. O. V. GREENE. Brit. 261,833, Aug. 24, 1925.
 Pressure filter for sirups or other liquids. J. N. S. WILLIAMS. U. S. 1,642,864, Sept. 20.
 Fabric filters for air or other gases. D. HALL, J. H. KAY and HALL & KAY, LTD. Brit. 261,897, Oct. 26, 1925.
 Funnel strainer for liquids. F. CHETHAM. Brit. 261,855, Aug. 31, 1925.
 Annealing furnaces. SIEMENS-SCHUCKERTWERKE GES. Brit. 262,444-5, Dec. 3, 1925.
 Gas-fired melting-pot furnace. L. F. TOOTH. Brit. 261,819, July 29, 1925.
 Device for supplying oxygen, oil, coal, ore or other substances to blast or melting furnaces through a blast nozzle. A. WAGNER and E. HILGERS. Brit. 261,776, Nov. 19, 1925.
 Recording device for gas-analyzing apparatus. SVENSKA AKTIEBOLAGET MONO. Brit. 261,803, Nov. 23, 1925.
 Apparatus for gas analysis. G. SOCOLOV-VISHNEVSKY. Brit. 262,316, March 23, 1926.
 Apparatus for sampling and analyzing gases flowing through pipes. R. EISENSCHUTZ. U. S. 1,643,155, Sept. 20.
 Apparatus for settling and thickening of mixtures of solids and liquids. W. C. WEBER. Brit. 262,179, Dec. 5, 1925.
 Column apparatus for distillation, rectification or treatment of liquids with gases. SOC. L'AIR LIQUIDE (SOC. ANON. POUR L'ETUDE ET L'EXPLOITATION DES PROCÉDÉS G. CLAUDE). Brit. 262,042, Nov. 28, 1925.
 Oven for distilling solid fuels or for drying materials. F. G. HOFFMANN. Brit. 261,740, Nov. 17, 1925.
 Double-walled vessel for carrying out reactions under high pressure and temperature conditions. J. TRAUTMANN. Brit. 261,767, Nov. 19, 1925.
 Recording device for wet- and dry-bulb humidity apparatus. E. B. WHEELER. U. S. 1,642,525, Sept. 13.
 Furnace for heating and unwinding rolls of wire. A. F. JACQUEMIN. U. S. 1,642,613, Sept. 13.
 Apparatus for subliming arsenic, antimony, lead, zinc or other substances. E. H. WEDEKIND. U. S. 1,642,756, Sept. 20.
 Apparatus and cabinet for testing hygroscopic substances. F. T. CARSON. U. S. 1,642,577, Sept. 13.
 Apparatus for treating acid sludge with salt solution, etc. L. BURGESS. U. S. 1,642,060, Sept. 13.
 Rotary kiln and heat recuperator. VICKERS, LTD., AND L. D. PARKER. Brit. 262,525, Sept. 12, 1925.
 Retort for distilling carbonaceous or other solid materials. F. D. MARSHALL. Brit. 261,919, June 5, 1925. Material is moved through an externally heated retort by Archimedeum screws the threads of which overlap but do not come into contact. Brit. 261,927 relates to similar app., as does also Brit. 261,975.
 Apparatus for fermentation and storage of fertilizer, foodstuffs and other materials. F. KRANTZ and H. KRANTZ. U. S. 1,643,018, Sept. 20.
 Strainer for gasoline or other liquids. R. D. FAGAN. U. S. 1,642,133, Sept. 13.
 Preheater and evaporator, for concentrating tanning liquors or other solutions. D. A. BLAIR AND BLAIR, CAMPBELL & MCLEAN, LTD. Brit. 262,608, Dec. 30, 1925.

Diffraction gratings with dichromated gelatin films. K. KONDO. Brit. 262,020, July 29, 1926.

Temperature-controlled alarm device. W. E. FOX. U. S. 1,642,649, Sept. 13.

Bimetallic element for thermostatic devices. W. M. CHACE. U. S. 1,642,485, Sept. 13. A Ni-steel alloy in which the Ni content is not greater than 42% is welded to a steel comprising C 0.50, Mn 0.70, Si 1.75, Cr 8, Ni 22, Cu 2, Co 1 and Fe 64.05 parts.

Thermostatic electric switch. O. G. MYERS. U. S. 1,642,742, Sept. 20.

Thermostatic control for electric circuits. F. W. WOOD. U. S. 1,642,284, Sept. 13.

Thermostatically controlled valve device. H. W. O'DOWD. U. S. 1,643,255, Sept. 20.

Thermionic valve. L. A. LEVY. Brit. 262,563, Oct. 27, 1925. A cathode is formed with an outer, electron-emitting surface of Ru or material contg. Ru. Ru chloride may be applied to a core such as W, Mo or fused SiO_2 and finely ground Bi or other metal more fusible than Ru may be added as a flux. A W core coated with Cu may be used for electrodeposition of Ru from its chloride soln. contg. Na phosphate and H_3PO_4 .

Bi-metallic strips for thermostats. F. W. MILLER. Brit. 262,644, April 21, 1926. A metal plate such as Ni-steel is covered with a flux such as powd fused borax and another metal such as brass, having a lower m. p. and in subdivided form, and the metals are caused to unite by heating and may be rolled and cut into strips.

Electron-emitting cathode. E. E. SCHUMACHER. Can. 272,015, June 28, 1927. A thermionic cathode comprises a W filament having a coating composed of a powdered metal of the Ce group.

Device for producing high vacuums with alkaline earth metal such as calcium. W. A. RUGGLES. Brit. 262,069, Nov. 27, 1925. A device is described applicable to evacuation of thermionic valves and similar app.

X-ray apparatus. M. B. ADRIAN. U. S. 1,642,915, Sept. 20.

Ultra-violet ray apparatus. HANOVIA CHEMICAL & MANUFACTURING CO. Brit. 262,703, May 1, 1926.

2—GENERAL AND PHYSICAL CHEMISTRY

GEORGE L. CLARK

Ira Remsen. W. A. NOYES. *Science* 66, 243-6(1927).—Biography. E. H.

David Lloyd Howard. ANON. *Pharm. J.* 118, 717; *Chemist & Druggist* 106, 784-5(1927).—Biography, with portrait. S. WALDBOTT

Caesar Augustin Grasselli. ANON. *Ind. Eng. Chem., News Edition* 5, No. 17, 7(1927).—Biographical note with portrait. E. H.

Daniel Berthelot (1865-1927). A. BOUTARIC. *Rev. sci.* 65, 353-7(1927).—An obituary outlining Berthelot's work. A. PAPINEAU-COUTURE

Raoul Lambert. F. M. *Ingénieur chimiste* 15, 93(1927).—An obituary with portrait. A. PAPINEAU-COUTURE

Kunkel and the early history of phosphorus. T. L. DAVIS. *J. Chem. Education* 4, 1105-13(1927). E. H.

A Russian physical chemist of the eighteenth century. B. N. MENSHUTKIN. *J. Chem. Education* 4, 1079-87(1927).—A biographical sketch of Michájlo Vasilievich Lomonosov. E. H.

Progress of chemistry in the first quarter of the twentieth century. S. C. LIND. *J. Chem. Education* 4, 1098-1104(1927). E. H.

A glance at the early organic chemistry of America. E. F. SMITH. *J. Chem. Education* 4, 1150-7(1927). E. H.

The solution of mathematical equations in chemical problems. S. K. TWREDDY. *Chemistry & Industry* 46, 824-5(1927). E. H.

Fundamental atomic weights. III. Revision of the atomic weight of silver. Analysis of silver nitrate. O. HÖNIGSCHMID, E. ZINTL AND P. THILO. *Z. anorg. allgem. Chem.* 163, 65-92(1927).—A method has been developed which makes it possible to reduce quant. molten AgNO_3 by means of H, insuring thus an analysis of the salt. In order to minimize the errors due to absorption of air, the weighing of both Ag and AgNO_3 has been performed *in vacuo*. Each analysis has been repeated 4 times. The av. of 14 detns. indicates that 168.92571 g. AgNO_3 yields 107.26868 g. Ag. Consequently the ratio $\text{AgNO}_3/\text{Ag} = 1.57479$ and the at. wt. of Ag = 107.879, on the assumption that $N = 14.008$. This is in agreement with the recent best values given for Ag. The value 107.872 obtained by Richards (*Chem. Rev.* 1, 17(1925)) was calcd. on the basis

N 14.004. The final paragraph discusses the results recently published by Baker and Riley (cf. *C. A.* 21, 1570, 2080, 2203). IV. The molecular weight of potassium. Analysis of potassium chloride. O. HÖNIGSCHMID AND J. GOUBEAU. *Ibid* 93-104.—Numerous analyses have been performed by the classical methods indicated by Richards. From the ratio $KCl/Ag = 0.691149$, the at. wt. of K is calcd. It equals 39.104. The same value is obtained when it is calcd. from the ratio $KCl/AgCl = 0.520180$. The ratio $AgCl/Ag = 1.328670$. V. The atomic weights of silver, chlorine and potassium. E. ZINTL AND J. GOUBEAU. *Ibid* 302-14(1927).—An exptl. detn. is made of the ratio KNO_3/KCl . The combination of this value with the ratios KCl/Ag and $AgCl/Ag$ already detd. in the second and third part of the work renders it possible to calc. the at. wt. of Ag, Cl and K. The at. wt. of N is taken as 14.008; the procedure has no new feature; every substance is weighed *in vacuo*. $KNO_3/KCl = 1.356111 \pm 0.000010$, $Ag = 107.879 \pm 0.0011$, $K = 39.104 \pm 0.0007$, $Cl = 35.456 \pm 0.0003$. VI. Revision of the atomic weight of chlorine. (1) A complete synthesis of silver chloride. (2) An incomplete synthesis of silver chloride. O. HÖNIGSCHMID, SAFFER BEDR CHAN AND L. BIRCKENBACH. *Ibid* 315-44.—In the first part, a known amt. of pure chlorine has been allowed to react on an equivalent amt. of pure silver, and the resulting $AgCl$ weighed. This method offers the possibility of checking the purity of the reagents. Nine detns. give $Cl/Ag = 0.328668$ within 1/100,000. Eight detns. of $Cl/AgCl$ give 0.247366. If Ag is taken as 107.880, the atomic weight of Cl in both cases = 35.457. In the second part, two different portions have been taken from a distn. of CCl_4 ; the two batches of HCl obtained therefrom have been compared with two batches of ordinary HCl , with the hope of detecting differences due to isotopes. The HCl was used in excess to ppt. a $AgNO_3$ soln. obtained by dissolving a known amt. of Ag in HNO_3 , and the ppt. weighed: $Cl/Ag = 0.32867$ and $Cl = 35.457$, on the basis $Ag = 107.880$. A. L. HENKE

Revision of the atomic weight of dysprosium. Analysis of dysprosium chloride. O. HÖNIGSCHMID AND H. FRH. AUER VON WELSCHACH. *Z. anorg. allgem. Chem.* 165, 289-96(1927).—Dy obtained from monazite was purified by fractional crystn. and converted into $Dy_2(SO_4)_3 \cdot 8H_2O$. The product contained traces of Th and Ho. The impurities amounted to less than 0.1%, which would affect the at. wt. by not more than 0.003 units. This lies within the exptl. error. The sulfate was converted to oxalate through hydroxide and nitrate. The oxalate was ignited and the oxide converted into $DyCl_3$ by HCl . The $DyCl_3$ was dehydrated and then melted and cooled in an atm. of dry HCl . At. wt. detns. from analyses yielding the ratios $DyCl_3:3Ag$ and $DyCl_3:3AgCl$ (total of 13 detns.) give the value $Dy = 162.459$. J. E. SNYDER

Revision of the atomic weight of yttrium. Analysis of yttrium chloride. O. HÖNIGSCHMID AND H. FRH. AUER VON WELSCHACH. *Z. anorg. allgem. Chem.* 165, 284-8(1927).—Previous detns. of the at. wt. of Yt gave for the purest sample, which still contained traces of Er, the value 88.950 (*C. A.* 19, 1212). This sample was further purified until no Er could be detected spectroscopically. Twenty detns. of the ratios $YtCl_3:3Ag$ and $YtCl_3:3AgCl$ give for the new at. wt. of Yt the value 88.925 ± 0.002 . J. E. S.

Modified micro-method for the determination of molecular weights. J. REILLY AND G. T. PYNE. *Sci. Proc. Roy. Dublin Soc.* 18, 489-93(1927).—The method depends on the alterations in the cooling curve of pure camphor produced by minute amts. of dissolved substances. The method is particularly useful for substances whose low soly. in camphor or high mol. wt. precludes the use of the ordinary Rast method. The app. and process are described in detail. L. W. RIGGS

Determination of molecular weights of organic substances in small quantities by means of freezing-point depression. BENNOSUKE KUBOTA AND TAKEO YAMANE. *Bull. Chem. Soc. Japan* 2, 209-12(1927).—A Ag-elec. resistance thermometer of high sensitivity was used to measure the depression in f. p. of a small amt. of dil. soln. in C_6H_6 , $PhNO_2$ or $C_2H_4Br_2$. A. W. FRANCIS

The variability of valency. PRAFULLA CHANDRA RAY. *Quart. J. Indian Chem. Soc.* 4, 89-95(1927).—The valency of an atom depends on: the nature of the atoms to which it unites; external conditions, temp., pressure, medium, presence of certain substances in the medium and relative concn. of reacting atoms. The Werner co-ordination number may have any value from 1 to 8 inclusive. Pt has valences of 1 to 4 and 6 in compds. with O and Cl. With mercaptanic radicals and org. sulfide Pt has all valences from 1 to 8 inclusive. The general formula is $Pt(SC_xH_4SH)_x$. Au forms the similar compds., $Au(SC_xH_4SH)_x$, where $x = 2$, or 3, or 4, or 5. Compds. of the formulas: $6A.Au_2Cl_3$, $5A.Au_2Cl_3$, $4A.Au_2Cl_3$, $4A.Au_2Cl_3$, $3A.Au_2Cl_3$ and $3A.Au_2Cl_3$ have been obtained when benzaldehyde trisulfide is treated with $AuCl_3$. The A of the formulas stands for 1,4-dithian. When dithioethyleneglycol and $AuCl_3$ are

allowed to react in acetone $[(CH_3)_2S_2]_nAu_2$ forms. Au is quinquevalent. By the action of NH_3 on $Au_2Cl_3 (C_2H_5)_2S_2$ a compd. of the compn. $Au_2Cl_3.6NH_3$ forms. No ordinarily accepted valency of Au explains this compn. F. E. BROWN

The dependence of the Avogadro number on the size of the particle. SATYENDRA RAY. *Z. physik. Chem.* **128**, 182-8(1927).—A mathematical discussion in which S. shows why the values for the Avogadro no. detd. by Millikan's method do not agree with those detd. by Perrin and why the no. can be independent of the size of the particle only when the latter is small. E. R. SCHIERZ

Molecular volumes at absolute zero. I. Density as a function of temperature. SAMUEL SUGDEN. *J. Chem. Soc.* **1927**, 1780-5.—The variation of d . with temp. from the f. p. to the crit. point is represented accurately in normal liquids, C_6H_6 , C_6H_5Cl , Et_2O , HCO_2Me , $AcOEt$ and CCl_4 by $D - d = D_0[(1 - T)/T_0]^{0.3}$, where D and d are the d . of the liquid and satd. vapor, resp., at T° abs. For associated liquids $AcOH$ and $EtOH$ it holds over the lower part of the temp. range. The "zero vol." V_0 obtained by dividing the mol. wt. by the const. D_0 is nearly proportional to the crit. vol. for H , Et_2O , CCl_4 , HCO_2Me , $AcOMe$, $C_2H_5CO_2Me$, $AcOEt$, HCO_2Pr , $C_3H_7CO_2Me$, methyl isobutyrate, $C_2H_5CO_2Et$, $AcOPr$, n -pentane, isopentane, diisopropyl, n - C_8H_{18} , n - C_8H_{18} , diisobutyl, C_6H_6 , fluoro- and bromobenzene. II. Zero volumes and chemical composition. *Ibid* 1786-98. S. shows the "zero vols." (cf. preceding abstr.) can be predicted by adding together certain characteristic consts for the atoms and structures in the mol. H 6.7, C 1.1, N 3.6, O 5.0, F 10.3, Cl 19.3, Br 22.1, I 28.3, P 12.7, S 14.3, O in alics. 3.0, N in amines 0.0 triple bond 15.5, double 8.0, 3-membered ring 4.8, 4-ring 3.2, 5-ring 1.8, 6-ring 0.6 and semi-polar double bond 0.0. Of the 284 compds. considered from the groups: hydrocarbons, halogen derivs., ethers, aldehydes and ketones, esters, nitro, P and S compds., and associated liquids, acids, alcs and amines 236 are within 2%, and 149 within 1% of the calcd. value. E. R. SCHIERZ

Volume laws of solid substances. WILHELM BILTZ. *Nach. Ges. Wiss. Göttingen. Math.-Physik. Klasse* **1926**, 45-80.—A statistical and crit. study of data taken from the literature shows a fairly const. relationship in the vols. occupied by the constituent radicals in solid substances at abs. zero. With a normal-zero vol. of NH_3 of 18.20 except in Hg salts, the zero vol. of NH_3 in the ammo fluorides and chlorides is normal, while in the bromides and iodides it runs high. It is concluded that in compds. of a higher order the lesser constituents occupy their zero vols., but that their simple additive properties are concealed by actions of a second order which are relatable to the individual characteristics of the component. This additive characteristic of the zero vols. is not so apparent in intermetallic compds. While the additive rule applies to chlorides and bromides fluorides and iodides generally show a vol. contraction and iodides a vol. dilation. La compds. also show strong vol. contraction. For the alkali halides the equation $v_1 = av_0 + b$ (where v_1 = vol. of the alk. halide, v_0 = vol. of K halides, $a = 1$, and b = the atomic vol. diff. between the metal and K) gives only a good approximation. Some compds. show half-values of their zero vol. for the metal constituent and others full values. The following general relations apply to these vol.-change phenomena: (1) the unstable metal isomers generally show a larger zero vol. than the corresponding stable isomer, and the ratios of the stable to unstable isomer vols. are expressible as small whole nos.; (2) borides and silicides give half-vol. values, sulfides $1/2$, $2/2$ and $3/2$ vols. for S , selenides give a double value, fluorides show values of $1/2$ -1, iodides $3/4$, and oxides $1/4$ - $1/2$, (3) in carbides, silicides, arsenides and borides the metal generally shows its full vol. as in intermetallic compds., while in sulfides, oxides, chlorides and fluorides the metal shows a "half vol."; (4) the constituent vols. of compds. contg. the same metal, which show equal vols. for diff. stages of oxidation of the metal are not additive, and the vols. of the acid radical vary between corresponding pairs of salts in the ratios of small whole nos.; (5) the zero vol. of O in compds. may assume a unit, half or quarter of its normal zero vol. and this is accountable for by the space lattice of the compds. in question. A parallel exists between the vol. ratios and the sp. heats of different modifications of the same substance. The data given show that in the limiting case the zero vol. of a compd. equals $\Sigma n/m \cdot v_0$, where v_0 is the zero vol. of the compd. constituents and n and m are small whole nos. whose quotient often equals 1. In many crystals the constituent does not enter according to the rational ratio called for by the limiting case, but with a more or less approx. partial vol. according to the particular substance.

C. D. INGERSOLL

The relationships governing the decrease in volume in the formation of solid compounds. I. ZASLAVSKIĬ. *J. Russ. Phys.-Chem. Soc.* **58**, 659-63(1926).—A discussion (cf. *C. A.* **19**, 3392). BASIL C. SOYENKOFF

The oscillation frequency in binary compounds. W. HERZ. *uZ. anorg. allgem. Chem.* **163**, 221-4 (1927).—In the Lindemann formula $\nu = 2.80 \cdot 10^{12} \sqrt{T_0/AV}$, ν = the oscillation frequency, T_0 = the m. p., A = the at. wt. and V = the at. vol. This formula is used for free elements. When 2 elements are combined in a binary compound, it is still possible to det. their ν by means of an analogous formula: the at. wt. and the at. vol. of each element are taken as the half of the mol. vol. and the mol. wt. of the combination. Therefore, $\nu/\nu' = \sqrt{T_0/T'_0}$, in which ν' = the oscillation frequency of the element when it is combined, and T'_0 = the m. p. of the compd. Taking data from the literature, H. shows that the last equation is correct, but he is unable to decide whether it is only a mathematical relation or a relation with a true physical meaning. A. L. HENNE

The hardness of inorganic compounds and of elements. ERNST FRIEDERICH. *Fortschritte Chem. Physik, physik. Chem.* **18**, 5-44 (1926).—The valence exerts a great influence upon the hardness of compds. and of elements. When the hardness is described as a function of at. concn. with the addn. of a valence factor the same order of hardness is obtained in the case of simple compds. as in Mohs' or Auerbach's scales. This equation permits the calcn. of the hardness of chem. compds. from the formula and the sp. gravity with a fair degree of accuracy. The hardness of solids which can be regarded as ionic or at. lattices is caused in a first approximation by electrostatic attraction according to Coulomb's law. The full validity of this law is impaired evidently by the action of rest affinities. In the case of elements which are conductors the idea is advanced that the hardness is owing to one part of the valence electrons, while the elec. cond. is due to the remaining valence electrons. This assumption is supported by the close relationship between hardness and elec. cond. particularly in the case of mixed crystals. EMIL KLARMANN

The preparation and some properties of pure metallic silicon. RUDOLF HOLBLING. *Z. angew. Chem.* **40**, 655-9 (1927).—A C filament was heated electrically at a temp. of about 1000° in a mixt. of SiCl₄ and specially purified H₂. In a few hrs. there was formed a bar of Si 4 mm. thick, with the undamaged C filament in the center. The Si could not be worked either cold or warm, even at 1400°. It appeared to be more brittle in the incandescent state than when cold. In this compact form it was very stable when heated in the air, and acquired only a slight tempering color. Its linear coeff. of expansion due to heat was measured röntgenographically. $\alpha_{18-950} = 3.55 \times 10^{-6}$. Its elec. cond. increased with rise in temp. A sketch of the app. used for the prepn. of the Si is given, also details of the method. LOUISE KELLEY

Tin-plague and museum sickness in Netherlands. ERNST COHEN. *Chem. Weekblad* **24**, 402-3 (1927).—Warning is given as to bringing sound tin into contact with infected articles. M. ACHTERHOF

The compressibility of tellurium. R. F. MEHL AND R. J. MAIR. *J. Am. Chem. Soc.* **49**, 1892-900 (1927).—The compressibility coeff. detn. and the piezometer standardization are made by Richards' methods (*C. A.* **9**, 2011). The approx. compressibility of H₂O, at 25°, is 41.54×10^{-6} . The av. of 6 detns., at 25° and 100-500 megabars, is 5.00×10^{-6} , accurate to 2 in the sec. decimal place. From the calcd. ds. for given values of h , the height of a unit prism, a curve is obtained, showing that the compressibility coeff. of Te is positive for values of h less than 5.55 A. U. and is negative above this. As the actual value of h is 5.91 A. U., the coeff. must be negative. In the same way it is shown that the coeff. must be positive for Se. It is predicted that other substances having a negative coeff. exist. J. BALCZIAN

Active sulfur. KARL STOCK. *Naturwissenschaften* **15**, 700 (1927).—Active S was prepd. in a way similar to the prepn. of active N. The band spectrum of its luminescence shows several characteristics, which will shortly be published. B. J. C. VAN DER HORVEN

The passivity of the metals. FRANCIS MEUNIER. *Bull. soc. chim. Belg.* **36**, 435-47 (1927).—A review. A. L. HENNE

X-ray method of determining coefficient of expansion at high temperatures. K. BECKER. *Z. Physik* **40**, 37-41 (1926).—The Debye-Scherrer method was used and the prepn. was heated by means of an elec. current through a W wire. For W, the linear coeff. from 18° to 2200° = 7.5×10^{-6} , from 18° to 1750° = 6.6×10^{-6} , from 18° to 1380° = 5.8×10^{-6} . For zircon, silicon, silicon carbide and the Nernst filament the values are 4.5, 3.55, 6.25 and 10.7×10^{-6} , resp., to the temps. 1300°, 950°, 1200° and 2000°. B. C. A.

The expansion of crystals from absolute zero to the melting point. W. P. DAVEY. *Phys. Rev.* **27**, 819 (1926).—Theoretical considerations of face-centered cubic crystals

indicate a linear expansion of at least 2.6% to be necessary between 0° K. and the m. p. There must be added the expansion while the atoms take up energy to overcome cohesion. Cu shows 2.9%. Body-centered cubic crystals require no expansion other than that to overcome cohesion.

R. L. HERSHEY

The temperature variation of the elasticity of Rochelle salt. R. MORGAN DAVIES. *Nature* 120, 332-3(1927).—The extension modulus of slabs of Rochelle salt has been detd. over a temp. range -30° to 40° .

C. H. GREENEWALT

Construction of crystals. V. M. GOLDSCHMIDT. *Z. tech. Physik* 8, 251-64(1927).—A lecture on the construction of crystals from at. building stones of known properties, radius and polarizability. The predicted macroproperties of the constructed crystals are discussed. Numerous references are given.

B. J. C. VAN DER HOEVEN

The symmetry of atoms in crystals. KARL HERRMANN. *Z. Physik* 42, 631-6(1927).—An examn. of the results of crystal analysis reveals that no crystal having unequivocally a purely hexagonal space group has yet been found; i. e., the atoms in all examd. structures appear only with the highest cubic symmetry or a lower symmetry derived from it.

R. L. HERSHEY

Lattice parameters and densities of copper, silver and tungsten. W. P. DAVEY AND T. A. WILSON. *Phys. Rev.* 27, 105(1926).—New expts. give for Cu, $a = 3.605$ A. U., corresponding to a d. of 8.95. A single crystal gave a d. of 8.953. A single crystal of Ag had a d. of 10.481, agreeing with earlier x-ray data indicating 10.49. W has $a = 3.155$ A. U., d. = 19.32.

R. L. HERSHEY

The crystal structure of α -manganese. A. J. BRADLEY AND J. THEWLIS. *Proc. Roy. Soc. (London)* A115, 456-71(1927).—Westgren and Phragmen's nomenclature is adopted and their powder data are used (cf. *C. A.* 19, 3181). The lattice is cubic, $a = 8.894$ A. U. New detns. of d. lead to 58 atoms per unit cell. Consideration of intensity data and space-group possibilities lead to the assignment of space group T_d^2 , with four sets of equivalent positions, contg. 2, 8, 24 and 24 atoms. Five parameters are needed and have been evaluated. The structure is based upon a single body-centered cubic lattice, each lattice point being replaced by a cluster of 29 atoms, the cluster having tetrahedral symmetry. The interat. distances range from 2.25 A. U. to 2.95 A. U. indicating an unequal distribution of electrons.

R. L. HERSHEY

Crystal structures of anatase and rutile, the tetragonal forms of titanium oxide. M. L. HUGGINS. *Phys. Rev.* 27, 638(1926).—Anatase has the dimensions, $a_0 = 3.78$ A. U., $c_0 = 9.50$ A. U. with Ti atoms at (000) $(0, \frac{1}{2}, \frac{1}{2})$ $(\frac{1}{2}, 0, \frac{1}{2})$ $(\frac{1}{2}, \frac{1}{2}, 0)$ and O atoms at (00u) $(0, \frac{1}{2}, u + \frac{1}{2})$ $(\frac{1}{2}, 0, u + \frac{1}{2})$ $(\frac{1}{2}, \frac{1}{2}, u + \frac{1}{2})$ (00 \bar{u}) $(0, \frac{1}{2}, \frac{1}{2} - u)$ $(\frac{1}{2}, 0, \frac{1}{2} - u)$ $(\frac{1}{2}, \frac{1}{2}, -u)$, where $u = 0.20 \pm 0.01$. The space group is D_{4h}^{19} . For rutile $a_0 = 4.58$ A. U., $c_0 = 2.95$ A. U. Ti atoms are at (000) $(\frac{1}{2}, \frac{1}{2}, \frac{1}{2})$; O atoms at ($\bar{u}, u, 0$) $(\bar{u}, \bar{u}, 0)$ $(\frac{1}{2} - u, u + \frac{1}{2}, \frac{1}{2})$ $(u + \frac{1}{2}, \frac{1}{2} - u, \frac{1}{2})$, where $u = 0.30 \pm 0.01$. The space group is D_{4h}^{14} .

R. L. HERSHEY

Crystal structure of zirconium oxide. W. P. DAVEY. *Phys. Rev.* 27, 798(1926).— ZrO_2 appears to crystallize in several forms. Two have been studied by the powder method. One shows a face-centered cubic lattice, $a = 5.098$ A. U. The strong lines indicate that the Zr atoms and O atoms are situated like the Ca and F atoms, resp. in CaF_2 . The second type shows a triangular close packed lattice, $a = 3.598$ A. U., $c = 1.633$ A. U. Both structures give a d. of 6.13.

R. L. HERSHEY

The lattice constants of CaO , $CaSe$, CaS , $CaTe$. IVAR OFFEDAL. *Z. physik. Chem.* 128, 154-8(1927).—The powder method, with rock salt as a standard, was used. The lattice dimensions are: CaO , $a = 4.802 \pm 0.005$ A. U.; CaS , $a = 5.686 \pm 0.005$ A. U.; $CaSe$, $a = 5.912 \pm 0.003$ A. U.; $CaTe$, $a = 6.345 \pm 0.008$ A. U. CaO , CaS , $CaSe$ have previously been shown to be of the NaCl type. Intensity calcs. indicate $CaTe$ to be of the same type.

R. L. HERSHEY

Precision determinations of the lattice constants of the compounds MgO , $MgSe$, MgS , MnO and $MnSe$. LINAR BROCH. *Z. physik. Chem.* 127, 446-54(1927).—The Debye-Scherrer method was used. The compds. are all of the NaCl type. The dimensions are: MgO , $a = 4.208 \pm 0.001$ A. U.; MgS , $a = 5.190 \pm 0.002$ A. U.; $MgSe$, $a = 5.452 \pm 0.002$ A. U.; MnO , $a = 4.435 \pm 0.002$ A. U.; $MnSe$, $a = 5.448 \pm 0.002$ A. U.

R. L. HERSHEY

The crystal structure of $MoSi_2$ and WSi_2 . WM. ZACHARIASEN. *Z. physik. Chem.* 128, 39-48(1927).—The powder method was used. $MoSi_2$ and WSi_2 are tetragonal, the lattice dimensions being, resp.: $a = 3.200 \pm 0.005$ A. U., $c = 7.861 \pm 0.005$ A. U., $c/a = 2.457$; $a = 3.212 \pm 0.005$ A. U., $c = 7.880 \pm 0.005$ A. U., $c/a = 2.453$. There are two mols. per unit cell. The elementary cell is body-centered; the space group

appears to be D_{4h}^{17} , with R(W or Mo) at (000), $(\frac{1}{2}, \frac{1}{2}, \frac{1}{2})$ and S atoms at $(00u)$, $(00 - u)$, $(\frac{1}{2}, \frac{1}{2}, \frac{1}{2} + u)$, $(\frac{1}{2}, \frac{1}{2}, \frac{1}{2} - u)$, where $u = 0.333 \pm 0.015$. R. L. H. HERSHEY

The space lattice of yellow lead oxide. F. HALLA AND F. PAWLEK. *Z. physik. Chem.* 128, 49-70(1927).—Powder rotation, Laue and oscillation x-ray photographs were taken of the yellow modification of PbO. The lattice is rhombic base-centered; the space group is either C_{2v}^{11} , V_6^6 or V_h^{19} , probably the last. The unit-cell dimensions are $a = 5.50 \pm 0.02$ A. U., $b = 4.72 \pm 0.03$ A. U., $c = 5.880 \pm 0.003$ A. U., there are 4 mols. per unit cell. The lattice is a mol. one, constructed of double mols., Pb_2O_2 . R. L. HERSHEY

Some crystal structures of the type NiAs. IVAR OFTEDAL. *Z. physik. Chem.* 128, 135-53(1927).—Powder examn. shows the following substances to be of the NiAs type (hexagonal lattice, 2 mols. per unit cell) and to have the dimensions recorded.

	a	c	c/a
CoSe	5.278	3.614	1.460
CrTe	6.211	3.981	1.560
MnTe	6.698	4.124	1.624
CoTe	5.360	3.886	1.380
NiTe	5.354	3.957	1.353
CrSb	5.468	4.107	1.331
MnSb	5.784	4.120	1.404
MnSb ₂	5.744	4.131	1.390
FeSb	5.130	4.064	1.262
FeSb ₂	5.168	4.123	1.253
CoSb	5.188	3.866	1.342
NiSb	5.133	3.907	1.314

The formulas for the Sb compds. of Fe and Mn are approx. empirical expressions of the compn.; these elements form solid solns. and the above dimensions probably vary with compn. R. L. HERSHEY

The crystal structure of ammonium fluoride. WILLIAM ZACHARIASEN. *Z. physik. Chem.* 127, 218-24(1927).—The structure of NH_4F , detd. by powder pictures and a Laue diagram is hexagonal closest packed, ZnO type, unit-cell dimensions: $a = 4.39 \pm 0.04$ A. U., $c = 7.02 \pm 0.06$ A. U.; there are two mols. per unit cell. The F atoms are at $(\frac{1}{2}, \frac{1}{2}, 0)$ and $(\frac{1}{2}, \frac{1}{2}, \frac{1}{2})$; the N atoms at $(\frac{1}{2}, \frac{1}{2}, \frac{1}{2})$ and $(\frac{1}{2}, \frac{1}{2}, \frac{1}{2})$. An H atom arrangement with the atoms tetrahedrally disposed about the N atoms and with one H atom on the line between each pair of N and F atoms is suggested as plausible in view of the tendency of NH_4F to decompose into NH_3 and HF. The space group is either C_6^6 or C_6^{4v} . R. L. HERSHEY

Structure of anhydrite. Structure of the sulfate group. J. A. WASASTJERNA. *Soc. Sci. Fennica Commentationes Phys.-Math.* 2, No. 19-30, 46 pp.(1927). cf. C. A. 21, 841.—The sulfate group is assumed to remain intact in different crystals. Its structure is studied by x-rays. Anhydrite was chosen as the most suitable material for study. The powder and Bragg spectrographic methods were used. Space group analysis and comparison with theoretical intensity are used in the study. The results are: the structure of anhydrite has the symmetry of V_h^{17} ; the axial lengths are $a_0 = 6.24$ A. U., $b_0 = 6.98$ A. U., $c_0 = 6.98$ A. U.; the axial ratio is $a_0:b_0:c_0 = 0.894:1:1000$, compared with the crystallographically detd. ratio $a:b:c = 0.893:1:1.001$, the unit cell contains 4 mols. The Ca and S atoms lie upon the intersections of the reflection planes $(010)_1$, $(010)_2$ and $(001)_0$, $(001)_1$. The 16 O atoms belong to two sets of 8 atoms each. The one group lies upon the reflection planes $(010)_1$, $(010)_2$; the other upon $(001)_0$, $(001)_1$. The at. coordinates are given. W. concludes, from the discussion of the existence of definite, intact groups, that the lattice must sometimes be assumed as built of anisotropic units larger than atoms, i. e., mols. or radicals. The sulfate group of anhydrite consists of 4 O atoms at the corners of a regular tetrahedron (within the limits of exptl. error) with an edge length of 2.7 A. U., the S atom being at the tetrahedron center. A study of the symmetry of the group in sulfates crystg. in different systems, shows the tetrahedron defined by the free sulfate group to be regular. The structure of anhydrite is similar to that of $LiKSO_4$, in agreement with W.'s theory of ionic radii. R. L. HERSHEY

Zinc blende-wurtzite lattices and ionic lattices. G. v. HEVESY. *Z. physik. Chem.* 127, 401-14(1927).—The electrolytic cond. of crystals and their melts is used to det. whether the lattice units are charged (ionic) or uncharged (mol.). A high electrolytic

cond. argues for ions; the cond. compared to NaCl cond. indicates the percentage of ions. In most cases apparently both kinds of structural units exist, which is in agreement with quantum ideas on the extension of the electronic field. BeO (wurtzite type) appears to consist mainly of uncharged units, which agrees with Grimm and Sommerfeld's and Goldschmidt's conclusions regarding commensurability and the character of the binding forces in diamond and wurtzite type lattices. In the case of α - (high temp.) AgI an ionic lattice occurs; the β - (low temp.) AgI (wurtzite type) has an at. lattice. The appearance of a metallic cond. is related to the presence of an uncharged lattice ingredient. The relation between loosening of the lattice and the appearance of polymorphic change is discussed. R. L. HERSHEY

Preliminary note on the crystal structure of some compounds of the constitution $M_2G_2L_2R_4$. O. HASSEL. *Z. physik. Chem.* **126**, 118-26(1927).—X-ray examn. of $ZnSiF_6 \cdot 6H_2O$ and $MgSiF_6 \cdot 6H_2O$ show the unit rhombohedrons to contain one mol. per unit cell. The b axis for the Zn salt is 9.325 A. U. long; for the Mg salt, 9.47 A. U. Possible space groups are discussed. R. L. HERSHEY

The crystal structure of the hexamminecobaltic iodides. KARL MEISEL AND WALTER THEDJE. *Z. anorg. allgem. Chem.* **164**, 223-40(1927).—Rotation and Debye-Scherrer photographs were used to det. the structure of $Co(NH_3)_6I_3$. The unit cell is face-centered cubic, with 4 chem. mols.; the cube edge length is 10.9 A. U. The space group is O_h^h or O_c . The Co atoms are at the corners and face centers, surrounded by the corresponding N atoms in the octahedral configuration and at a distance of about $1/6$ the cube edge. The I atoms are of 2 kinds: those of the first kind form an inner cube with edge length of $1/2$ the unit cell edge length, those of the second kind are at the midpoints of the edges and in the cube center. The structure of $Co(NH_3)_6I_2$, detd. by Scherrer and Stoll, is lacking the I atoms of the second kind. The mol. vols. are the same since the addn. of the second kind of I atoms in $Co(NH_3)_6I_3$ requires no addnl. space in the lattice. R. L. HERSHEY

The crystal structure of $[N(CH_3)_4]_2PtCl_4$. M. L. HUGGINS. *Phys. Rev.* **27**, 638 (1926).—Laue and spectrum photographs are used. The structure is cubic with $a = 12.65$ A. U. Pt and N atoms are arranged as Ca and P in CaF_2 . Each Pt atom is surrounded by 6 Cl atoms octahedrally, each N atom by 4 C atoms tetrahedrally. The space group is either O_h^h or O_c . Assuming the N-C distance as 1.17 A. U., the Pt-Cl distance appears to be about 2.35 A. U. R. L. HERSHEY

Crystal structures of ammonium, potassium and rubidium cupric chloride dihydrates. S. B. HENDRICKS AND R. G. DICKINSON. *J. Am. Chem. Soc.* **49**, 2149-62 (1927). These compds. have been examd. by Laue and spectral photographs. They are tetragonal with 2 mols. per unit cell, the dimensions are: for the NH_4 salt, $a = 7.58$ A. U., $c = 7.96$ A. U.; the K salt, $a = 7.45$ A. U., $c = 7.88$ A. U.; the Rb salt, $a = 7.81$ A. U., $c = 8.00$ A. U. The space group is probably D_{4h}^{14} . R. L. HERSHEY

The crystal structure of quinone. II. W. A. CASPARI. *J. Chem. Soc.* **1927**, 1093-5; cf. *C. A.* **21**, 1211.—The modification of quinone deposited at ordinary temps. from a MeOH soln., β -quinone, has a d. of 1.31 and m. p. of 166°. Laue and rotation x-ray photographs show it to belong to the trigonal polar class, the unit cell dimensions being $a = 16.21$ A. U., $c = 5.53$ A. U. There are 9 mols. per unit cell, with 3 lattice units per unit cell, each contg. 3 mols. The 3 mols. per unit have no symmetry, either separately or as a group. The space group appears to be C_3 . γ -Quinone, formed by sublimation has a d. of 1.35, m. p. of 169°. Rotation photographs give the dimensions, $a = 13.24$ A. U., $b = 5.20$ A. U., $c = 8.11$ A. U. The space group appears to be C_{2h}^b , built up on the lattice Γ_m ; γ -quinone is less stable than the other forms. Quinone tends to crystallize in the trigonal system and to associate in termol. units. The c axes of the trigonal modifications, α - and β -quinone, are nearly equal; the a axes are nearly in the ratio 4 to 3. R. L. HERSHEY

Variability of long diffraction spacings in paraffin waxes. G. L. CLARK. *Nature* **120**, 12; *Science* **66**, 136-7(1927).—The examn. of 4 commercial paraffin waxes having m. ps. of 135°, 130°, 125° and 120° F. on an oscillating spectrograph with $CuK\alpha$ radiation reveals an increase in the long spacing with m. p. increase when the samples are prepd. identically. The 135° wax, cooled upon a glass plate with varying rapidity shows an increase from 36.64 A. U. for instantaneous cooling to 40.20 A. U. when cooling from just above to just below the m. p. took 60 min., intermediate cooling times giving intermediate values. The presence of addn. agents affects the spacing, 1% of Pb oleate impressing its own spacing 37.5 A. U. upon the whole mixt. R. L. HERSHEY

The resemblance of the fluorosulfonates to the perchlorates in chemical and crystallographic relationships, and a fluorophosphate. WILLY LANGE. *Ber.* **60B**, 962-70

(1927).—By the addn. of an aq. soln. of NH_4 fluorosulfonate to solns. of the chloride or acetate of the proper bases, L. has prepared tetramethylammonium fluorosulfonate, the *o*-toluenediazonium salt, and some alkaloid fluorosulfonates. Mixed crystals of the fluorosulfonates and perchlorates of Cs, K, Li, tetramethylammonium and the Cu-4-pyridine complex were obtained, as were mixed crystals of the corresponding permanganates and fluorosulfonates. The crystallographic examn., only begun, indicates that the simple fluorosulfonates at least resemble the perchlorates. The crystallographic and chem. examns. of the known and new fluorosulfonates and the comparison with the corresponding perchlorates and permanganates show a considerable similarity of the salts. The properties of these anions, ClO_4^- , SO_3F^- , etc. are independent of the atonicity and position in the periodic table of the central atom. Ion vol. appears important, the aq. soly. appearing to increase with increasing ion vol. Phosphoroxo fluoride, POF_3 , in cold H_2O gives POF_2OH , difluorophosphoric acid. The nitron salts may be pptd. by adding nitron acetate. The detailed description of the prepn. of the fluorosulfonates and the fluorophosphate is given. R. L. H.

The isodimorphy of the alkaline earth sulfates and the alkali perchlorates. D. VORLANDER AND HERBERT HEMPEL. *Ber.* 60B, 845-8(1927).—The alkali perchlorates undergo a transition and become optically isotropic upon heating. V. and H. investigate this property with the polarization microscope in the isomorphous alkaline earth sulfates and chromates. No transition was observed for the chromates, which are unusually luminescent when heated. BaSO_4 , CaSO_4 and SrSO_4 showed the transition, as did PbSO_4 . The alkaline earth selenates showed no transition, nor did Ca tungstate, Pb tungstate and Pb molybdate. These last three are not isomorphous with the others, being tetragonal.

The theory of crystal growth. HERBERT BRANDES. *Z. physik. Chem.* 126, 196-210 (1927).—The crystal form is detd. by the most slowly growing faces. The growth is considered to be discontinuous and to take place plane by plane. If, upon an already complete crystal plane, a nucleus of a new plane forms, energy is used to construct the nucleus boundary, thus increasing the vapor pressure of the nucleus and tending to send it back into soln. By a consideration of the energies of formation of such nuclei upon different crystal faces of NaCl, it is shown that these energies are greatest for the cubic face, less for the rhombododecahedral face, and least for the octahedral face. Hence, the rates of growth of the different faces decrease in the above order. The theory also explains the occurrence of imperfections in crystals. R. L. HERSHEY

Rate of growth of crystals in aqueous solution. G. H. MONTILLON AND W. L. BADGER. *Ind. Eng. Chem.* 19, 809-16(1927).—The rates of crystn. of Na_2SO_4 and MgSO_4 in a new continuous crystallizer were detd. over a temp. range of 27° to 31° . A definite relation exists between wt. of material crystd. and the new surface generated during crystn. under definite conditions of concn. changes. The probable effects of temp. and viscosity changes are discussed. A method of predicting probable size of the crystals produced is given.

R. L. HERSHEY

Investigation of the rate of growth of crystals in different directions. MARIE BENTIVOGLIO. *Proc. Roy. Soc. (London)* A115, 59-87(1927).—The rates of growth of the various faces of crystals of the three isomorphous salts, $\text{Mg}(\text{NH}_4)_2(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$, $\text{Fe}(\text{NH}_4)_2(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$ and $\text{MgK}_2(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$ and the polar K and NH_4 tartrates have been measured. The crystal under examn. was suspended by a horizontal pin lying in the horizontal axis of rotation of a slowly revolving flask contg. the soln. This arrangement removed the inequalities due to convection currents, and enabled the faces of the zone parallel to the axis to be studied. For measurement the crystal holder was removed from the soln. and mounted on a microscope stage, the position of the graduated head, when sharply focused, being noticed, the change in this position, after addn. growth, being the measure of the growth. The measurements show that similar faces of a simple form grow at the same rate, even when of different size; hence a misshapen crystal, grown under uniform conditions, tends towards but does not reach the ideal form with equal faces. On a combination, unlike faces grow at different rates, while like faces grow at the same rate unless certain of them are adjacent to a large face of another faster growing form, which apparently causes impoverishment of the soln. in its neighborhood and destroys the uniformity of the conditions. Except in this case there is a const. ratio between the rates of growth of any two different forms. In the case of polar crystals the rates of growth of parallel faces may be widely different. In an isomorphous series of salts the orders of increasing rates of growth of different forms are not const. throughout the series. These last two facts seem to prove that the rate of growth cannot be simply related to reticular density. Ideal forms for the crystals studied are developed from the normal rate of growth ratios. R. L. H.

The effect of gelatin on the size and distribution of macroscopic crystals grown from aqueous solutions. T. S. ECKERT AND W. G. FRANCE. *J. Phys. Chem.* **31**, 877-81 (1927).—Crystals of CuSO_4 and $\text{Pb}(\text{NO}_3)_2$ were grown by evapn. from solns. contg. gelatin, the dishes contg. the crystals photographed and the negatives projected upon a calibrated screen, allowing size and distribution to be detd. The presence of gelatin produces a marked decrease in av. size; increasing the concn. of gelatin increases the uniformity of the crystals. No differences were noticed in the effects of two grades of gelatin. The results indicate a similarity in the action of gelatin as affecting microscopic crystals formed either by electro- or chem. pptn. on the one hand and macroscopic crystals grown by evapn. from aq. soln. on the other hand. R. L. H.

Lattice variations in the formation of mixed crystals by precipitation from solutions. L. VEGARD. *Z. Physik* **43**, 299-308(1927).—Mixed crystals of $\text{HgCl}_2\text{-HgBr}_2$ of various compns. and formed by the addn. of a mixed soln. of KCl and KBr to a soln. of HgNO_3 were examd. by the x-ray powder method. The lattice dimensions depend not only upon the compn., but also upon the method of pptn. A ppt. formed by rapid addn. of the KCl-KBr soln. has dimensions varying widely from those predicted by V.'s additive law, the variation being much greater in a than in c (the lattice is tetragonal). Ppts. formed by addn. of the soln. drop by drop have dimensions much nearer the additive law values, which are apparently limiting values. The variations are shown not to be due to inhomogeneity. The width of line shows the rapidly pptd. crystals to have the smaller particle size, hence a larger proportion of "uncompensated" surface atoms, which exert a deforming influence upon the possibly deformable mercurous ion. The additive law represents the case of large crystals, i. e., very slow pptn. R. L. HERSHEY

New kinds of mixed crystals. II. D. BALAREFF AND G. KANDILAROV. *Z. anorg. allgem. Chem.* **162**, 344-8(1927); cf. *C. A.* **21**, 517.—Four forms of BaSO_4 were prepd.: (1) a cross-form, by pptn. of 0.05 N H_2SO_4 with 0.5 N BaCl_2 ; (2) by slow diffusion of 0.5 N BaCl_2 into 0.5 N H_2SO_4 ; (3) an x-form pptd. as in (1); (4) large crystals by simultaneously dropping 0.5 N BaCl_2 and 0.5 N H_2SO_4 into boiling H_2O , acidified with HCl . The loss of wt. was detd. upon heating after drying. All showed some water content, (2) being highest with 0.46 mol. H_2O per mol. BaSO_4 , and (4) lowest with only 0.07% H_2O . Form (2), upon rubbing in a mortar, drying and heating showed a decrease in loss in wt. with increased rubbing, indicating mechanical enclosure of the H_2O . Form (1), unfiltered, becomes violet colored upon standing 2 or 3 days in KMnO_4 soln. without any other change in external appearance, the phenomenon being apparently a capillary one. When filtered and calcined, or dried over H_2SO_4 , (1) does not become colored; the H_2SO_4 -dried sample when ground to a powder again becomes colored when placed in KMnO_4 . (1) changes from violet to a bright red upon standing 9 months in the same soln. This appears to be due to recrystn. III. *Ibid* **163**, 141-4.—A detn. of the sp. gr. of forms (2) and (4), (4) being considered pure, shows that the entire H_2O content of (2) was mechanically enclosed in the crystals. Detns. of the effect of BaSO_4 suspensions upon the reaction velocity of permanganate and HCl shows that the suspension diminishes the velocity, but by different amts for different permanganates. The effect cannot be that of a chem. inert suspension, since sand used instead of BaSO_4 , has no influence. The different effect upon different permanganates can be thought of as due to different adsorption by the BaSO_4 (cf. following abstr.) R. L. HERSHEY

New kinds of mixed crystals. IV. D. BALAREFF, N. GANTSCHW AND B. SREBROW. *Z. anorg. allgem. Chem.* **165**, 192-4(1927); cf. preceding abstr.—In the presence of Cu^{++} , Zn^{++} was pptd. completely by H_2S in a soln. contg. sufficient HCl to prevent pptn. of Zn^{++} when present alone. No Zn was dissolved from the mixed ppt. by treating it with HCl at 95° for 4 days. In other expts., Zn^{++} was added to pptd. CuS in HCl soln. the soln. was neutralized with $(\text{NH}_4)_2\text{S}$ or Na_2S and then concd. HCl was added. The resulting ppt. contained Zn as well as Cu . When AcONa was substituted for $(\text{NH}_4)_2\text{S}$, however, the product contained no Zn . B. considers the ppt. to be composed of ZnS adsorbed on CuS rather than a Zn-Cu complex. J. E. SNYDER

Relation between composition and solubility of mixed crystals. B. HABER-CHUWIS. *Rocz. Chem.* **6**, 700-4(1926).—Data representing the soly. of mixed crystals of copper and ferrous ammonium sulfates at 0° and at 8.2° and of ferrous and zinc potassium sulfates at 6.8° are recorded. Thiel's law is followed in both cases. Nernst's distribution law is, however, true only for the former pair of salts, where the solubilities of the constituent salts are low and close to one another, but not for the second pair, where the solubility difference is greater. B. C. A.

What are mixed crystals? E. HALPERN. *Rocz. Chem.* **6**, 661-78(1926).—Data for the soly. of mixed crystals of Mn and Cu NH_4 sulfates at 6.8° and of Ni and Cu NH_4 sulfates at 0° and 8.5° are recorded. The results are in agreement with Retgers' (*Z. physik. Chem.* **3**, 497-561) and Thiel's laws (*Z. physik. Chem.* **43**, 641-70(1903)) Nernst's distribution law is, however, only approx. satisfied, applying more closely when the solubilities of the constituent salts of a mixed crystal are close to one another.

B. C. A.

Nature of mixed crystals. A. PLOIN. *Rocz. Chem.* **6**, 690-9(1926).—The solubilities of mixed crystals of Cu and Co K sulfates at 0° and 7.8° and Cu and Zn K sulfates at 6.8° are recorded. The results confirm the conclusions of Halpern (cf. preceding abstr.).

B. C. A.

Solubility of mixed crystals. B. BERTSCH. *Rocz. Chem.* **6**, 705-10(1926).—The solubilities of mixed crystals of Cu and Co NH_4 sulfates at 0° and at 8° and of Cu and Mn NH_4 sulfates at 7° confirm the conclusions of Halpern (cf. preceding abstracts).

B. C. A.

Additive qualities of mixed crystals. D. OSTERSETZER. *Rocz. Chem.* **6**, 679-88(1926).—The solubilities of mixed crystals of ferrous and Zn NH_4 sulfates at 7° and of Cu and Ni NH_4 sulfates at 0° and 8° have been detd. Temp. differences do not appear to affect the relative solubilities of the constituent salts in the latter case. The results confirm the conclusions of Halpern (above).

B. C. A.

Nickel-chromium solid solutions. F. C. BLAKE AND A. E. FOCKE. *Phys. Rev.* **27**, 798(1926).—A complete series of nichrome alloys has been studied by the x-ray powder method.

R. L. HERSHEY

Banded structure in aluminum and copper. C. F. ELAM. *Nature* **120**, 259(1927).—X-ray examn. of the banded structure in Al and Cu showed that twinning in the octahedral plane is not always the case. Both parts of the Al twin appeared to have one dodecahedral plane in common, but the plane of junction had no relation to the crystal structure of either twin. This latter was also true of Cu, no important plane or direction appeared common to both parts.

R. L. HERSHEY

Etch planes in metallic single crystals. H. H. POTTER AND W. SUCKSMITH. *Nature* **119**, 924(1927).—The examn. of the etch planes of Fe, Ni and Al by optical reflection show Fe to give {100} planes as etch planes, Al to give {100} and occasionally {110}, and Ni to give {111} and {100}. X-ray examn. of Ni agrees with the optical data.

R. L. HERSHEY

Recrystallization phenomena in aluminum. A. E. V. ARKEL AND M. G. V. BRUGGEN. *Z. Physik* **42**, 795-806(1927).—The no. of recrystallization nuclei in Al is detd. by the increase in tensile strength caused by deformation, the recrystallization being always at the same temp. The deformation must have a certain threshold value to cause any recrystallization, this value being smaller for smaller crystals. The rate of growth in recrystn. decreases with decreasing deformation to practically zero at the threshold value. Hence recrystn. may not occur after smaller deformation, in consequence of the slow rate of growth. A crystal deformed below the threshold value cannot grow at the expense of more strongly deformed crystals at its boundaries.

R. L. HERSHEY

Increase of tensile strength of single crystals by plastic deformation. F. SCHMID. *Z. Physik* **40**, 54-74(1926).—The increase of strength of the main faces of slip in Zn crystals caused by plastic extension has been investigated; after passing the elastic limit, the strength increases linearly with the extension. The shape of the extension curve for single crystals depends on the angle between the slip and the direction of the applied force. The group of curves relating the force in the main plane of slip to the extension can be represented by a single line almost straight. A comparison is obtained for the increase in strength along the actual planes of slip and the latent planes (which cut the former) for crystals of Zn and Sn; if the 2 planes are crystallographically identical, the increase of strength is less in the actual than in the latent planes; for Zn, in which the planes are not the same, the increase is greater in the main actual plane of slip.

B. C. A.

The distortion of crystals of aluminum under compression. II. Distortion by double slipping and changes in orientation of crystal axes during compression. G. I. TAYLOR. *Proc. Roy. Soc. (London)* **A116**, 16-38(1927); cf. *C. A.* **20**, 3107.—During compression of a disk cut from a single crystal of Al, the crystal axes take a position in which 2 possible planes of slip are symmetrically disposed in relation to the stress. The orientation of the crystal axes relative to the normal to the flat surface of the specimen is different from their orientation relative to the axis of a tensile test piece. After the axes have taken the symmetrical position, Laue photographs show that they remain in such a position even when compression continues until thickness of specimen is only

0.28 of its original thickness. **III. Measurements of stress.** *Ibid* 39-60.—With expl. conditions adjusted so that the effect of friction on the surface of a specimen under compression is negligible, it is possible to measure internal shearing stresses. Identical relationships hold between shear stress and amt. of shear in both tension and compression. During slipping on two planes, resistance to shear increases more rapidly for a given total amt. of slipping than when all slip is confined to one plane.

R. J. HAVIGHURST

Application of Fourier's series to crystal analysis. R. T. HAVIGHURST. *Phys. Rev.* 55, 881 (1925).—H. describes an application of the quantum theory and the correspondence principle to the problem of electron distribution in crystals. The relative reflecting powers of the crystal planes of certain salts are obtained from x-ray measurements by the powder method. The square roots of these relative reflecting powers are used as coeffs. in a Fourier series. The distribution of electron intensity is obtained for different directions through the crystal, and comparisons are made between different salts of the same general structure

R. L. HERSHEY

The reflection of electrons from crystal lattices. F. ZWICKY. *Proc. Nat. Acad. Sci.* 13, 518-25 (1927).—The analogy between the reflection patterns for slow electrons observed by Davison and Germer (*C. A.* 21, 1927) and the diffraction of x rays is not complete in that the whole effect in the case of electrons is produced by the first few layers on the crystal surface. A derivation is given in terms of the wave mechanics for the diffraction of an electron beam by a single-lattice plane. A pattern is obtained similar to that for the reflection of light by a ruled crossed grating. The resolving power for a finite lattice is calcd. The reflecting power of a single plane is so large that it is not possible to treat this case by analogy with x rays. The interference pattern cannot be computed by assuming that the rays penetrate a great no. of layers.

F. A. JENKINS

The compressibility isotherms of hydrogen, nitrogen and mixtures of these gases at 0° and pressures to 1000 atmospheres. (A correction.) E. P. BARTLETT. *J. Am. Chem. Soc.* 49, 1955-7 (1927); cf. *C. A.* 21, 1387.—A calibration, with more exact instruments, of the pressure gage used in the recently published work shows it to be accurate to within 0.1% at pressures up to 100 atms. and 0.62% at 200 atms., the error becoming less at higher pressures. At 100 atms. the corrected results agree to within 0.26% for H_2 and 0.11% for N_2 with Holborn and Verschoyle, almost exactly at 200 atms. and above by 0.34% with Amagat, and, at pressures to 100 atms., for 3 gas mixts., to within 0.1% and at 200 atms. to within 0.4% with Verschoyle. Tables of corrected compressibility factors, ds. and const. are given

J. BALOZIAN

A transformation of theoretical chemical constants. E. WERTHEIMER. *Physik. Z.* 27, 771-4 (1926); cf. *C. A.* 15, 2770.—Herzfeld has shown that a simple derivation of the theoretical chem. const. can be given by combination of the gas equation with the equation for the number of particles in an ideal monoat. gas coexisting with a solid phase at sufficiently low temps. In contrast to Planck, who assumes that the const. h depends directly upon the gaseous and not at all upon the solid phase, H. states that h (which occurs in his equation) is detd. by the properties of the solid and has nothing to do with the gas; actually the classical theory only is used for the description of the state of the gas. W. finds that both conceptions can be combined based on the premise that the contemplated monoat. substance consists of Bohr's atoms; this permits the application of Bohr's laws regarding the structure of matter to this problem. E. K.

The chemical constant of the diatomic molecules. F. J. v. WISNIEWSKY. *Z. Physik* 44, 392-5 (1927).—Using his model of the diat. mols., W. calcs. the const. of the chem. equil. between diat. mols. The values thus obtained for Cl_2 , Br_2 , I_2 and H_2 check the ones given in the literature (*Z. Physik* 29, 1-36 (1924)). These values are also calcd. for O_2 , N_2 , CO , CO_2 and NH_3 .

A. L. HENNE

Characteristic equation of gases. K. SHIRA. *Proc. Imp. Acad. (Japan)* 2, 398-400 (1926).—A discussion of the equation of state advanced by S., in which it is concluded that the equation of Clausius cannot be considered as a corrected form of that of van der Waals. The limitations of Goebel's equation are discussed and the law of intermol. force is deduced to be of the inverse 8th or 9th power for CO_2 , in approx. agreement with Debye's theory.

B. C. A.

Mobilities of ions in acetylene-hydrogen mixtures. L. B. LOEB and L. DU SAULT. *Proc. Nat. Acad. Sci.* 13, 510-6 (1927); cf. *C. A.* 21, 1221, 1222.—New measurements are reported of the mobilities of gaseous ions in C_2H_2 and mixts. of C_2H_2 with H_2 in varying proportions. For C_2H_2 alone, in agreement with Erickson (*C. A.* 21, 701) the negative ions are found to have a slightly higher mobility than the positive ions, although the difference is probably illusory, due to the probable presence of free electrons

which was indicated by the expts. It is concluded that both ions have the same initial mobility, viz., 0.708 cm./sec. per \sqrt{v} /cm. In the presence of H_2 the mobilities follow the law of mixts. for non-reactive gases, with no indications of clustering on either ion. Contrary to Frickson's interpretation of the abnormal mobilities in C_2H_2 in terms of bimol. ion formation, it is supposed that the effects are due to the free electrons, as is also probably true in the case of H_2 . F. A. JENKINS

Methods of determining distillation factors. E. ÖMAN. *Teknisk Tidskrift, Upp-
laga C (Kemi)* 57, 27-30(1927).—The distn. factor is defined as the ratio between the content of the more volatile component in the vapor and in the liquid during distn. of a mixt. of liquid substances. Various methods of detg. this ratio are described and the disadvantages are outlined. In a newly designed app. shown diagrammatically, the vapor is sampled from the tube B where it is completely homogeneous. When the factor is to be detd. at increased or reduced pressure the arrangement shown by C is used. The points a and b then have to be connected by a rubber tube. Corrections are introduced for the amts. of liquid and vapor in circulation in the app. If the compn. of liquid and vapor is difficult to det. by analysis the compn. of the phases can be estd. by making a series of very accurate b. p. detns. This procedure has been employed with mixts. of water and methanol. C. A. ROBAK

Determining the distillation curve of benzene-toluene. E. ÖMAN. *Teknisk Tidskrift, Upplaga C (Kemi)* 57, 35-8(1927); cf. preceding abstr.—The distn. curve of the mixt. benzene-toluene has been detd. The method of analysis employed is similar to that for carbohydrates (C. 1 21, 1077). A suitable quantity of 70% alc. is added, the mixt. cooled and the temp. observed at which the mixt. begins to pale, the "paling point." The cooling was at the rate of 0.4° per min. The amt. of alc. added must be measured exactly: 820 cc. alc. to 200 cc. of the mixt. to be analyzed having been found a suitable ratio. Since the concn. of the alc. has a great influence upon the paling point, the same alc. must be used for all detns. or, if it is preferred, the exact concn. of the alc. can be detd. by measuring its paling point with pure toluene. Detns. of the distn. factors were made with mixts. of pure benzene and toluene in 6 different proportions and the distn. curve was set up. In mixts. contg. 1, 2, 3, 4, 5, 10, 20 and 30% of benzene the factors were, resp. 3.6, 3.2, 3.0, 3.0, 2.8, 2.4, 1.9 and 1.7. In the mixts. contg. more benzene the found values are considered less accurate. C. A. ROBAK

Separating benzene and toluene in fractionating columns. E. ÖMAN. *Teknisk Tidskrift, Upplaga C (Kemi)* 57, 38-41(1927)—By means of the distn. curve (cf. preceding abstr.), calcns. are made of the chief conditions governing the fractionating process, such as the no. of floors, the quantity of heat applied, etc., with a special view to mixts. contg. about 5% of benzene and 95% of toluene. C. A. ROBAK

Density and temperature. VI. W. HERZ. *Z. Elektrochem. angew. phys. Chem.* 33, 348-9(1927); cf. C. A. 20, 320.—The relationship $(d - d_0)/a(t - t_0)^b = 1$ holds, in which d is the density of any liquid at the temp. t , d_0 and t_0 are the crit. values and a and b consts. characteristic of the material. Calcns. are given for $MeOOCII$ at temps. 30° to 190° , for $HOAc$ at temps. 20° to 310° , Cl_2 from -100° to 120° , A from -182° to -125° and N_2 from -208° to -150° . There is no progressive change in the value of the quotient, which is const. within 2 or 3%. Other cases have been calcd. with equal success, but the results are not given. A. W. KENNEY

A new method for measuring vapor densities. PHILIP BLACKMAN. *Chem. News* 135, 97-100(1927).—The method consists in enclosing the liquid whose vapor density is to be measured in a double U shaped glass app. over Hg. The app. is so constructed that the vol. of inclosed air, vapor of the substance being measured and the displaced Hg can readily be detd. The v. p. may be detd. either above or below atm. pressure, by slightly altering the form of the app. The d. of 35 org. compds. detd. with this app. is given. Substances reacting with Hg cannot be detd. J. W. SHIPLEY

The volumetric determination of the density of liquid substances. B. LYASKO. *Nauchnue Zapiski* (Russian) 4, 308-14(1927).—According to a phys. law the height of a liquid column is inversely proportional to its sp. gr. at the same diln., that is, if one designates by a the height of the column of the liquid in mm. b the diln. in mm. of the height of the column of water, x the sp. gr. of the liquid, then $a = b/x$ and $x = b/a$.

In constructing a new app. for the detn. of the d. of sugar products use has been made of the above formula. The value of a is a const. equal to 1, and x is therefore equal to $b/1 = b$. The value for b is found by reading a scale. From practical considerations the unit a is 650 mm., and a scale is made up to read the sp. gr. of liquids ranging between 0.65 and 1.5, to 0.001. The app. is described (illus.) with directions for its use. A table for the direct reading of the content of dry matter calcd. from the sp. gr. of sugar solns. accompanies the article. J. S. JOFFE

Graphical method for the construction of the viscosity-shear gradient curve. E. HATSCHKE. *Kolloid-Z.* 41, 11-4(1927).—A purely graphical method of constructing the viscosity-shear gradient curve is developed from an equation derived in a previous paper (*C. A.* 20, 3607). B. C. A.

Viscometry by variation in velocity of flow, and a new viscometer. W. O. OSTWALD AND R. AUERBACH. *Kolloid-Z.* 41, 56-62(1927).—Existing forms of viscometer are described and critically discussed. A new type of viscometer (the "over-flow" viscometer) is described. In this form, the liquid is contained in a vertical, graduated tube, falls through hydrostatic pressure through a capillary tube, and overflows by means of a U-tube into a receptacle. The methods of measurement and calcn. of results are demonstrated. B. C. A.

H. LeChatelier's viscosity law. P. LAZAREV. *Compt. rend.* 185, 106-7(1927); cf. *C. A.* 19, 878.—LeChatelier's law for the viscosity (η) of glass as a function of the temp. can be written $\log \eta/\eta_0 = N - M/t$, or $\log \eta = \log \eta_0 + 10^N - M/t$, or $\eta = \eta_0 10^{10N - M/t}$, in which η_0 , M and N are consts. The formula is also accurate in the case of viscous liquids, calcd. values agreeing very closely with the exptl. values of Thorpe and Rotgen (Landolt-Bernstein, *Physik. Tabellen* 1, 5 Aufl., 1923, p. 151) for AmOH. Numerous viscosity detns. by the falling-sphere method have shown the formula to be applicable also to molasses and solns. of sugar in glycerol, the av. differences between calcd. and exptl. values being 1.21-1.51% and max. difference 4%. A. PAPINEAU-COUTURE

The viscosity of liquids above their boiling points. III. TOSHIKO TITANI. *Bull. Chem. Soc. Japan* 2, 196-201(1927); cf. *C. A.* 21, 3291.—The sp. fluidity, ϕ_1 , of CO_2 plotted against the sp. surface, $V_1^{2/3}$, gave a nearly straight line. The values of ϕ_1 from known data were compared with those calcd. from the equation $\phi_1 = K_1 (V_1^{2/3} - B_1)^{1/2}$, where $K_1 = 3060$ and $B_1 = 0.669$ and found to be in fair agreement. The relation between mol. fluidity ϕ and temp. is $\phi = \phi_k - C(T_k - T)^{1/2}$, where ϕ_k is the value of ϕ at the crit. temp. T_k and C is a const. When $\phi = 0$, the viscosity is infinity and the temp. obtained from the equation was found to be very near to the f. p. for many substances. Also, this temp. is about $7/20$ of T_k . The relation $V^{2/3} = V_k^{2/3} - A(T_k - T)^{1/2}$ was obtained between the orthobaric vol. and temp. and found to agree well with exptl. data. E. R. SMITH

The measurement of small vapor and partial pressures. H. v. HALBAN AND K. SIEDENTOPF. *Z. angew. Chem.* 40, 661-6(1927).—A brass rod is mounted vertically in a glass tube through which the gas passes, the upper end of the rod being held at 0° in an ice bath and the lower end at -76° in a bath of ether and solid CO_2 . The point at which dew or solid is deposited on the rod is an index to the concn. of the vapor in the gas used. This app. must be calibrated by the use of known mixts. and is said to be accurate for the measurement of partial pressures of H_2O in air of less than 1 g. per cu. m. Very small amts. of the gas sample suffice for a detn. J. H. PERRY

Solution of the ammonium chloride problem. A. SMITS. *Rec. trav. chim.* 46, 445-52(1927).—An app. for the simultaneous measurement of the vapor pressure and vapor density of dry and moist NH_4Cl at temps. between 280° and 310° is described. The app. is called a densi-tensimeter. A Jena-glass bulb of 10 cm. diam. contains a quartz knife edge and a graduated glass scale. From measurements with this app. it is concluded that the vapor pressure of NH_4Cl is lowered by intensive drying. The inner transformations of NH_4Cl by heating are not stopped by intensive drying, but a marked shifting of the inner equil. is observed. This shifting of the equil. diminishes as the temp. is increased and completely disappears at 310° . The vapor d. of 26.75 was found at 286° . This is explained by assuming that larger mols., as well as NH_4Cl , NH_3 and HCl mols. are present. The association increases with decreasing temp. The calcd. mol. heat of vaporization decreases from approx. 64,000 cal. at 280° to approx. 20,000 cal. at 325° . The results are interpreted on the basis of the previously published theory of the internal equil. between NH_4Cl and $(\text{NH}_4\text{Cl})_n$ mols. (cf. *C. A.* 17, 3815). R. L. DODGE

Polishing of surfaces. N. K. ADAM. *Nature* 119, 162-3(1927).—It appears unnecessary to suppose that actual liquefaction occurs, an amorphous layer indistin-

guishable from a supercooled liquid being formed by any mechanism which rearranges the surface mols. at random. Moreover, the resolidification of a liquefied surface layer might result in crystn. B. C. A.

A new capillary phenomenon. A. JANEK. *Kolloidchem. Beihefte* 24, 418-48 (1927).—If a reaction resulting in a ppt. takes place between 2 components, one of which is dissolved in a jelly that is spread out in a thin layer on a glass plate, and the other is dissolved in a liquid drop placed beside the jelly, a banded, jelly-like membrane holding the ppt. sometimes forms over the surface of the drop. The membrane bands exhibit a structure typical of the system and in no way connected with rhythmic pptn. within the jelly. It takes place in cases where rhythmic pptn. within the jelly is absent. The phenomenon results from a rhythmic extension of the drop in projections between jelly layer and glass surface. Reaction between components in jelly and drop on contact forms a fringe of ppt. in the jelly touching the drop. When the fringe reaches a certain thickness, the drop pushes under the fringe and lifts it to the surface of the liquid. Repetition of the process forms the banded membrane. The jelly contg. the ppt. is more easily torn away from the glass than the jelly contg. no ppt.

F. L. BROWNE

The surface tension of molten metals. I. Copper. E. F. LIBMAN. *Proc. Nat. Acad. Sci.* 13, 588-92 (1927).—The "capillary const." of Cu with total impurities amounting to 0.019% varies from 0.308 to 0.297 in a temp. range from 1083-1318° and for impure Cu with impurities amounting to 0.11% the values vary from 0.301 to 0.275 in the same temp. range. These values are calcd. from the depression of molten Cu in contact with a vertical plane and in a capillary tube. M. F.

Capillarity and displacement. K. SCHULTZE. *Kolloid-Z.* 41, 6-11 (1927); cf. C. A. 21, 6, 1388.—Expts. are described on the behavior of pairs of non-miscible liquids in capillary spaces. When light petroleum is contained in a capillary tube, and water, colored with ammoniacal cupric oxide, is drawn up into the tube, the water begins to spread from the meniscus sepg. the two liquid phases, and along the sides of the glass tube, displacing therefrom the petroleum. Finally, the petroleum-glass interface becomes entirely a water-glass interface, irrespective of which liquid is placed on top. B. C. A.

Surface tension of sodium. F. E. POINDEXTER. *Phys. Rev.* 27, 820 (1926).—Detns. of the surface tension of Na were made, by a modified flat-drop method in a high vacuum, over a temp. range from 105° to 245°. Values at 100° and 250° are 222 dynes/cm. and 211 dynes/cm., giving a temp. gradient of 0.072 dyne/cm. per degree; k in the Eötvös relation is 0.62, which is interpreted to mean the mols. in liquid Na are polyat. R. L. HERSHEY

Determination of the surface tension by means of capillary rise. **Surface tension of water, ethyl alcohol, boron trichloride and silicon tetrachloride.** HERBERT MILLS AND P. L. ROBINSON. *J. Chem. Soc.* 1927, 1823-32.—Using glass tubes of much smaller bore ($r = 0.07325, 0.20168, 0.25287, 0.27165, 0.41354, 0.49920$ mm.) than have been previously used, the authors have detd. at 25° ± 0.01 the surface tension γ of H₂O (I), EtOH (II), BCl₃ (III) and SiCl₄ (IV). At 20° $\gamma =$ (I) 72.90 ± 0.04 , (II) 22.05 ± 0.01 , (III) 16.70 ± 0.01 , (IV) 19.71 ± 0.01 provisional. The change of γ per degree is 0.15, 0.09, 0.11 and 0.12, resp. It was found that several hrs. were required for the meniscus to attain a const. level. F. R. SCHIERZ

Capillary activity of filter paper. L. JENDRASSIK AND A. CZIKE. *Biochem. Z.* 185, 470-6 (1927).—The surface tension of an aq. soln. is usually raised when its surface is quickly wiped by a strip of filter paper. If the paper remains in contact with the surface for a while there is a lowering of the surface tension either due to the spread of surface-tension-lowering impurities present in filter paper which are removable by extraction with alc., or in the case of solns. of alkaloid salts this is occasioned by a rise in the p_H due to the binding of acid. S. MORGULIS

Studies on permeability. Surface activity of the dye trypan blue on different surfaces. N. OKUNEFF. *Biochem. Z.* 187, 37-50 (1927).—Trypan blue is capillary inactive at the H₂O/air boundary, but strongly active at H₂O/C₆H₆, H₂O/petroleum ether or H₂O/olive oil. The surface tension at these boundaries is reduced to $\frac{1}{2}$ by the addn. of trypan blue to the H₂O. The lowering of the surface tension shows definite and typical dependence upon the dye concn., age of the surface of contact or of the dye soln. itself. Trypan blue shows the greatest surface activity at the H₂O/petroleum ether interface and the least at the H₂O/olive oil interface. S. MORGULIS

Measurement of the temperature effect on surface energy of solutions and biological fluids as a means of determining the surface tension of dissolved substances. P. REHBINDER. *Biochem. Z.* 187, 32-6 (1927).—The total surface energy σ of chemically

pure liquids is almost independent of T , but this is not the case where solns. instead of pure liquids are examd., the value of σ diminishing because one of the 2 soln. components is adsorbed on the surface boundary. S. MORGULIS

Spheroidal state of liquids on heated metallic surfaces. I. MÔSCICKI AND J. BRODER. *Rocz. Chem.* 6, 321-54(1926).—App. is described for the concn. of HNO_3 in iron vessels, corrosion being avoided by heating the iron to such a temp. that no wetting of the surface takes place. Expts. were made to det. the limiting temps. at which the wetting of wires immersed in various liquids comes to an end. The conception of "adsorption pressure" is introduced, this being the pressure exerted on the metal surface by the mols. of the layer of liquid wetting it; the actual pressure exceeds this by the pressure of the atm. Hence the b. p. of this layer is higher than that of the rest of the liquid, and is identical with the limiting temp. at which wetting ceases. It is shown that this temp. is a const. for a given liquid and metal, invariably higher than the b. p. of the former, and independent of its temp. The limiting wetting temp. for aq. solns. of non-electrolytes at a Pt surface is higher than for pure water (130°) pointing to a greater concn. of solute in the surface layer. It increases according to the series Pt, Fe, Ag, Ni, Cu and Pb. B. C. A.

Adsorption at crystal faces. I. The growth and solution of single copper sulfate crystals in the presence of gelatin and dyes. T. S. ECKERT AND W. G. FRANCE. *J. Am. Ceram. Soc.* 10, 579-91(1927).—Crystal growth and soln. were studied by means of a moving-picture camera. Gelatin decreases the rate of growth of CuSO_4 crystals and changes the growth velocity at a nonuniform rate in different directions. Quinoline yellow, bismark brown and methylene blue greatly change crystal habit and decrease rate of growth. Naphthol yellow, ponceau 2R and methyl violet have no effect. Viscosity and convection currents are the important factors in detg. the rate of soln. in gelatin or dye. Sp. adsorption is believed largely responsible for changes in crystal form produced by gelatin or dye. C. H. KERR

Adsorption by carbon in viscous media. G. WEISSENBERGER AND S. FRANKEL. *Kolloid-Z.* 41, 14-27(1927).—The amount of I adsorbed by various charcoals from glycerol solns. was detd. by titration after equil. was attained. Measurements of the viscosity of the solns. were also made. Expts. were carried out on the adsorption of I from aq. soln. by carbon, kaolin and ruddle. The results show that the formula of Lockemann and Paucke (*C. A.* 5, 3531) holds in highly viscous solns., and that the relation between total adsorption and the viscosity of the medium is given by the formula $m_T = \Gamma \cdot \eta^{1/r}$, where Γ and $1/r$ are consts. The formula $m_T = K \cdot \eta^p$, where η is the initial concn. and K and p are consts., was found to hold in the cases examd., but is of only empirical significance. It is shown that coloring matters can be detd. in boiling soln. contg. strong H_2SO_4 by means of permanganate titration. The max. error observed was $\pm 1.2\%$. B. C. A.

Adsorption. ALBERT AUBRY. *Bull. soc. ind. Mulhouse* 93, 284-304(1927).—An address dealing with its theory, general laws and industrial applications. A. P.-C.

The activation of wood charcoal by progressive oxidation in relation to bulk density and iodine adsorption. A. B. P. PAGE. *J. Chem. Soc.* 1927, 1476-94. Samples of wood charcoal taken from a large standard stock supply were oxidized at various temps. between 500° and 900° , and at atm. pressure by a slow stream of air or of O-N mixts. rich in N. The appearance, apparent d., % yield, sorptive capacity for I in C_6H_6 soln., and rate of I sorption of the treated samples were compared. The sorption isotherms were detd. for 22 and for 150 hrs.' shaking for each sample over a range of concn. from 0.01 N to 0.2 N I in C_6H_6 . The isotherms were mostly parabolic. The Freundlich consts. were plotted against the degree of oxidation of the charcoal. The k and $1/n$ curves can be built up from simple curves of 2 quantities, one of which decreases, while the other increases with oxidation. The available surface is considered to be the quantity that increases, and the effective no. of attracting centers per unit surface, the quantity that decreases. R. L. DODGE

Swelling of activated charcoal. P. N. PAVLOV. *Kolloid-Z.* 42, 112-9(1927).—Both animal and sugar charcoal were tested with solns. of acid and base for swelling. The concn. of the solns. is a function of the swelling and in some cases a max. or min. point is found. Cane-sugar charcoal swells much less than animal charcoal and appears to have 2 min. points. The iso-elec. point of the charcoal was also detd. at $p_H = 8.3$. Graphite swells in many liquids and some values are recorded of these, together with the charcoals previously described for the same liquids. Swelling and absorption are closely related. R. H. LAMBERT

Active charcoal. Charcoal activated by mineral substances. M. SWIDEREK. *Rocz. Chem.* 6, 603-32(1926).—Charcoal activated by carbonization in presence of

mineral substances such as ZnCl_2 or asbestos owes its activity to the extension of its surface by the fine division of the charred mass on the mineral bases. Its adsorptive power is detd. by the dimensions of the pores, and these, again, depend on the rapidity of carbonization. Such charcoal-covered granules adsorb gases and decolorize liquids at about the same rate as ordinary charcoal. The activity of such activated charcoal varies with the proportion of the charcoal in the prepn. B. C. A.

The so-called adsorption of ferric oxide hydrosol by charcoal. A. W. THOMAS AND T. R. LE COMPTE. *Fourth Colloid Symposium 1926*, 328–54 (Chem. Catalog Co.).—The charcoals used were: tech. Norite; com. blood charcoal; cane-sugar charcoal; Norite purified by 6 M HCl and 10 weeks' washing; bone charcoal similarly purified. The iron oxide sols were made by adding 10 M NH_4OH to 27 M FeCl_3 soln. which had been first mixed with an equal vol. of H_2O . The NH_4OH was added dropwise until the ppt. dissolved with difficulty, and prolonged dialysis reduced the Fe/Cl ratio from 17.9 to 48.6. From the exptl. data educed, the following conclusions are drawn: Purified charcoals do not adsorb Graham iron oxide sols; the high removal powers of tech. charcoals are essentially due to the pptg. action of their electrolyte impurities; the operation of the "liminal value" principle being evident; the principle of "exchange adsorption" satisfactorily accounts for the phenomena observed; purified charcoals have negligible adsorption on FeCl_3 solns., at least up to 0.02 M ; tech. Norite has high, but purified Norite slight, removal power toward HCl , and up to 0.004 M HCl a comparison of titration and gravimetric detus. shows that only about $1/4$ as many mols. of Cl ion are removed as of H ion. Sufficiently purified charcoal does not ppt. Au sols. JEROME ALEXANDER

Adhesion forces in solutions. IX. The adsorption of substances from dilute aqueous solutions in the presence of nonelectrolytes. MICHAEL DUBININ. *Z. physik. Chem.* 128, 266–84 (1927); cf. *C. A.* 20, 3605.—The adsorption of HCl by activated charcoal from $\text{MeOH}-\text{H}_2\text{O}$, ether- H_2O , and acetone- H_2O soln. was measured. The presence of the org. compds. decreased the HCl adsorption and changed the shape of the isotherm. The effect is attributed to adsorption of the org. substance, being most pronounced with ether, and least with MeOH . Measurements of ether, acetone and MeOH adsorption from aq. solns. substantiate this explanation. Measurements of the adsorption of grape sugar and AcOH from aq. solns. contg. ether, acetone and MeOH show a similar decrease in adsorption, but a less pronounced change in shape of the adsorption isotherms. R. L. DODGE

Adsorption and diffusion phenomena in the electrical field—theoretical remarks on a paper of the same name. REINHOLD FURTH. *Z. physik. Chem.* 126, 238–46 (1927).—A discussion of earlier papers (cf. *C. A.* 21, 200 and *C. A.* 21, 2005). The phenomenon under these conditions is not truly electrolysis nor cataphoresis, but a coöperation of field effect and diffusion. On one electrode both kinds of ions are absorbed. This electrode is that one to which the ion of less mobility is drawn by the field. The amt. of the common ion absorption is detd. by the rule that on the cathode the deposition of both kinds is greater the higher the atomicity of the cation against that of the anion, and *vice versa* at the anode. R. L. HERSHEY

The interfacial activity and energy on different surfaces and their specific adsorption capacity. P. REHBINDER. *Biochem. Z.* 187, 19–31 (1927).—The interfacial activity of a capillary-active substance at the boundary of 2 phases increases as the difference in polarity of the 2 phases increases. This accounts for the fact that many biologically important substances like dyes, adrenaline and fatty acids are much more active (*i. e.*, are more adsorbed) on a $\text{H}_2\text{O}/\text{hydrocarbon}$ (petroleum ether, benzene) than on a $\text{H}_2\text{O}/\text{air}$ boundary. It is further shown that the difference in polarity of 2 fluid phases can be detd. from the difference in soly. of the substance in the 2 phases as well as the surface tension $(\sigma_{12})_0$ of the 2 phases in pure condition. The activity $G = \Delta\sigma/\Delta c$ at the boundary of 2 fluid phases varies directly as the σ_0 value. If H_2O is in contact with another phase of varying polarity (hexane, C_6H_6 , olive oil) or is itself replaced by a less polar fluid contg. OH groups, the value of G increases regularly with the increasing change in polarity. The distribution of a capillary-active substance between 2 phases is demonstrated to depend upon the surface action on each side of the boundary. The surface activity is a means of measuring the purity of a substance. Thus, for instance, natural adrenaline is much more active than the synthetic product at a $\text{H}_2\text{O}/\text{C}_6\text{H}_6$ surface boundary, *i. e.*, the adrenaline base is much more adsorbed than the salt. S. MORGULIS

Adsorption of ions and of sols at interfaces and its application to certain problems of colloid chemistry. N. R. DHAR. *Quart. J. Indian Chem. Soc.* 4, 173–81 (1927).—A review is given of 10 years of work at Allahabad. The greater the valency of an

ion, the less it is adsorbed. The amt. of adsorption is increased by chem. affinity. Sols may adsorb ions carrying the same charge as the sol. ° The abnormal behavior of sols with regard to general diln. rule, mixts. of electrolytes, positive acclimatization, and decrease of viscosity on the addn. of small concns. of electrolytes is mainly due to the adsorption of similarly charged ions. Increase in charge of a sol decreases its viscosity and hydration. Some sols are adsorbed strongly by their freshly pptd. unpeptized solids. These form Liesegang rings in which a layer of ppt. follows a clear space. Other sols are not adsorbed by their freshly formed unpeptized ppt. They form Liesegang rings of alternating colors with no clear spaces. The first type of behavior is exhibited by Ag_3CrO_4 , PbCrO_4 , $\text{Fe}(\text{OH})_3$, etc. The second type of behavior is exhibited by Sb_2S_3 , CdS , MnO_2 , etc. References are given to previously published articles.

F. E. BROWN

An experimental test of the Gibbs adsorption theorem: a study of the structure of the surface of ordinary solutions. J. W. MCBAIN AND GEO. P. DAVIES. *J. Am. Chem. Soc.* **49**, 2230-54(1927).—A simple method is described for accurately measuring the abs. adsorption at an air-liquid interface. Aq. solns. of *p*-toluidine, amyl alc. and camphor were studied by this method. In every case, the amts. actually adsorbed were several times greater than that corresponding to a monomol. film. It is concluded that over a wide range of concn. a surface of these solns. consists of a satd. monomol. film of solute resting upon a comparatively thick layer of concd. soln., gradually decreasing in concn. with depth to the bulk concn. of the soln. The structure is that of chains of oriented mols. of solute extending downward into the soln. from the outermost monomol. film. The so-called concn. formula of Gibbs is shown to give erroneous values for adsorption. The true thermodynamic formula of Gibbs must be used, and all the components, including the elec. effects, must be taken into account. R. L. DODGE

Influence of adsorbed substances on chemical equilibrium in solution. RENÉ DUBRISAY AND JEAN BRAVARD. *Compt. rend.* **185**, 385-6(1927).—The concn. of dissolved Ca in equil. with CaCO_3 and various amts. of NH_4Cl was measured in the presence and in the absence of diatomaceous earth. In every case the concn. of sol. Ca was increased by the presence of the earth, the influence of which was greater the lower the temp. The importance of this displacement of equil. in the fixation of fertilizers by soil is indicated.

R. L. DODGE

The diffusion of small particles in a liquid. WARREN WEAVER. *Z. Physik* **43**, 296-8(1927).—A mathematical discussion of the time required for the establishment of a stationary equil.

A. L. HENNE

Visible and latent differentiated zones in macroscopic homogeneous suspensions. A. STEIGMANN. *Kolloid-Z.* **41**, 18(1927); cf. *C. A.* **15**, 638; **16**, 690.—A description is given of the differentiated zones formed by colloidal pptd. Ag salts. These have in some cases a cellular structure and resemble anatomical preps. The differentiation is more apparent when the system is exposed to bright daylight than in diffused light.

B. C. A.

Rhythmical precipitation of calcium hydroxide. W. M. FISCHER AND A. SCHMIDT. *Rocz. Chem.* **6**, 404-14(1926).—Periodic variation in light intensity may cause rhythmical pptn. of $\text{Ca}(\text{OH})_2$. True rhythmical pptn., due to chem. factors alone may be observed when CaCl_2 soln. diffuses into a NaOH soln. under a cover-glass. The $\text{Ca}(\text{OH})_2$ which is at first pptd. soon disappears, being replaced by an unstable hydrate, $2\text{Ca}(\text{OH})_2 \cdot \text{H}_2\text{O}$, which then rapidly changes back to the stable normal hydroxide. The optical and crystallographic constns. of these two hydroxides are detd. and compared.

B. C. A.

***Solubility and grain size. IV.** D. BALAREFF. *Z. anorg. allgem. Chem.* **163**, 213-6(1927).—An alcoholic aq. soln. of H_2SO_4 has been used to ppt. alcoholic BaCl_2 and alcoholic Ba acetate. The first colloid has been washed 37 times, the second 17 times. The sizes of the smallest particles were 0.1μ and less than 0.1μ , resp. A suspension of these colloids in water has a cond. at 25° of $3.3-3.9 \times 10^{-6}$, against 2.86×10^{-6} for a normally satd. soln. After two weeks, the cloudiness had not yet vanished. A finely cryst. ppt. of BaSO_4 has been obtained by adding $0.5 N \text{H}_2\text{SO}_4$ drop by drop to a boiling $0.5 N \text{BaCl}_2$ slightly acidified with HCl . The size of the smallest particles was 0.2μ . The cond. at 25° was 3×10^{-7} , and after a very long washing dropped to 2.89×10^{-6} . If water containing a BaSO_4 suspension is submitted to temp. fluctuations, and constantly shaken, 6 fluctuations between 12° and 28° are sufficient to cause the disappearance of the small 0.2μ particles. By fluctuation between 24° and 53° , no effect can be detected after one hr. It takes 12 hrs. for a supersatd. gypsum soln. to come in equil. with a gypsum plate, whereas it takes only $1\frac{1}{2}$ hrs. for the plate to reach the satn. point when it is put into water. The ratio of the 2 processes is thus

$\frac{1}{4}$. When a suspension of BaSO_4 in H_2O is stirred for $2\frac{1}{2}$ hrs., the no. of smaller particles increases, but when the stirring is continued for 30 hrs. the smaller particles disappear completely. This will explain the fact that it takes a longer time for pulverized and stirred gypsum to reach equil. than it does for a gypsum plate. It has never been definitely proved that smaller BaSO_4 particles are more sol. than larger ones.

A. L. HENNE

Colloidal syntheses with the aid of titanium trichloride. I. Hydrolysis and oxidation products of titanium trichloride. A. GUTBIER, BERTA OTTENSTEIN, EDITH LEUTHEUSSER, K. LOSSEN AND F. ALLAM. *Z. anorg. allgem. Chem.* **162**, 87–100 (1927).—An aq. soln. of TiCl_3 yields colloidal TiO_2 by dñ., heating and action of the air. The reaction can be controlled by measuring the variation of the p_{H} . The steps are: $\text{TiCl}_3 \rightarrow \text{TiCl}_2 \rightarrow \text{TiClO}_2\text{H} \rightarrow \text{TiO}_2\text{H}_2$. The formula of the colloidal titanic acid must be represented by $\text{TiO}_2 + x\text{H}_2\text{O}$, x being very variable and depending on the method of prepn. No definite hydrate can be traced. The x -ray analysis shows the TiO_2 lattice to be analogous to that of anatase or rutile, depending on the sample of titanic acid. **II. Colloidal gold and colloidal selenium.** A. GUTBIER, BERTA OTTENSTEIN AND K. LOSSEN. *Ibid* 101–9.—The hydrolysis and oxidation of TiCl_3 renders it easy to obtain colloidal Au or Se from AuCl_3 or SeO_2 . TiO_2 is a strongly protective colloid.

A. L. HENNE

Colloid syntheses with the aid of titanium trichloride. III. Colloidal copper. A. GUTBIER AND BERTA OTTENSTEIN. *Z. anorg. allgem. Chem.* **164**, 274–80 (1927); cf. C. A. **21**, 351; cf. preceding abstract.—Cu-Ti-“purple” was prepd. as follows: 0.42% TiCl_3 soln. was heated to boiling, converting it in part to $\text{TiO}_2 \cdot x\text{H}_2\text{O}$, which acts as protecting colloid. The soln. was cooled rapidly to room temp. and to 5 cc. of it was added 5 cc. of 0.025% CuSO_4 or CuO . Within 5 or 10 min. the Cu was reduced to deep-red, colloidal Cu. The sols made with CuO were very stable, especially when not dialyzed. Sols containing more than 0.04% Cu even if dialyzed remained undecomposed for several weeks when kept in stoppered containers, but more dil. sols oxidized readily. Dry colloids could not be prepd. because they oxidize too easily. The fresh, unwashed ultrafiltrate from the sols could be redispersed in H_2O . Sols prepd. from CuO were more stable than those made from CuSO_4 , because SO_4^{--} has a pptg. action. The sols made with CuO were stable on boiling and on freezing. The sols were exceptionally sensitive to electrolytes, had a viscosity close to that of H_2O , were polydispersed according to ultramicroscopic observation, and were positively charged as detd. by cataphoresis. **IV. Colloidal rhodium.** A. GUTBIER AND E. LEUTHEUSSER. *Ibid* 281–6.—Colloidal Rh protected by $\text{TiO}_2 \cdot x\text{H}_2\text{O}$ was prepd. by the same method used for colloidal Cu except that Na_3RhCl_6 replaced the CuO . The reaction was quant., requiring 3 mols. of TiCl_3 per mol. of Na_3RhCl_6 . The sol could be dialyzed until it contained 0.4% Cl^- and still remain stable, but on longer dialysis it formed a jelly and finally coagulated. The coagulum could be peptized with HCl or NH_3 . The sol with NH_3 was stable for only a few days. The residue obtained by evaporating Rh sol to dryness remains sol. in H_2O for several days, but the soly. gradually diminishes until it becomes insol. The sol was found to be polydispersed; its viscosity was similar to that of H_2O ; it was relatively resistant to electrolytes, catalytically decomposed hydrazine hydrate, and was positively charged. **V. Colloidal bismuth and antimony.** A. GUTBIER, BERTA OTTENSTEIN AND F. ALLAM. *Ibid* 287–96.—Bi-Ti-“purple” was prepd. in analogous manner to the Cu-“purple” by using $\text{Bi}(\text{OH})_3$ in place of CuO and using NaOOCCH_3 to regulate the p_{H} of the TiCl_3 soln. The Bi sol must be kept sealed from air to protect it from oxidation. The dry colloid also oxidizes readily. The sol was found to be stable on boiling or on freezing. It had a viscosity similar to that of H_2O ; it was positively charged and polydispersed. Sb-Ti-“purple” was prepd. by adding a suspension of $\text{SbOCl} \cdot x\text{H}_2\text{O}$ to hot TiCl_3 soln. and dialyzing. The sol oxidized very easily. It was positively charged, stable on freezing, polydispersed, and had the viscosity of H_2O .

F. L. BROWNE

Synthesis of red dispersoidal solutions of gold by means of aqueous extracts from fresh leaves of plants. EIICHI IWASAKI. *Bull. Chem. Soc. Japan* **2**, 187–91 (1927).—Exts. were prepd. by boiling fresh leaves in H_2O 10 min. and filtering. Ten cc. of ext. and 10 cc. of 0.1% $\text{HAuCl}_4 \cdot 4\text{H}_2\text{O}$ soln. were added simultaneously to 500 cc. boiling distd. H_2O , and boiling was continued until the soln. was 260 cc. (25 min.). The red colloidal sols. thus formed were perfectly stable. Maple and cherry-leaf exts. gave reddish violet sols; pine needles, bamboo leaves and camellia leaves gave bright red sols.

A. W. FRANCIS

The synthesis and properties of colloidal molybdic acid. S. I. D'YACHOVSKII AND A. V. DUMANSKIY. *J. Russ. Phys.-Chem. Soc.* **58**, 630–8 (1926).—Molybdic acid

sol was prepd. by adding HCl to dil. solns. of Na_2MoO_4 . Cond. measurements showed a min. at the neutral point corresponding to 7 equiv. of HCl per 10 of Na_2MoO_4 . F.-p. measurements and tests with $\text{K}_4\text{Fe}(\text{CN})_6$ prove the formation of the complex $\text{Na}_2\text{O}(\text{MoO}_3)_4$, crystals of which were obtained from solu. of the above compn. With 12 equivs. of HCl, the complex $\text{Na}_2\text{O}(\text{MoO}_3)_8$ was isolated (mol. wt. by f. p. 1139, max. intensity of Tyndall conc); this sol does not coagulate at 100° nor on addn. of electrolytes. No particles were visible under the slit ultramicroscope. Further addn. of HCl breaks up the complex salts. An analogous phenomenon was observed with a negatively charged suspension of freshly pptd. MoO_3 whose equiv. cond. increased on diln. Another method of prepn. was by satg. 1 N Na_2MoO_4 with MoO_3 ; these sols exhibited no Tyndall cone. The authors conclude that the "semicolloid" is formed by the addn. of MoO_3 to the neutral salt in steps, and its micelle has an indefinite chem. compn. although the nucleus closely corresponds to $\text{Na}_2\text{O}(\text{MoO}_3)_8$. B. C. S.

The preparation of monodispersed silver hydrosol free from protecting colloids. I. J. VOIGT AND J. HEUMANN. *Z. anorg. allgem. Chem.* **164**, 409-19(1927).—The usual Ag hydrosols are polydispersed and contain varicolored submicrons. Sols with uniformly colored particles can be prepd. It is necessary to have materials of the utmost purity and to use very dil. Ag solns. As starting material, a soln. of Ag_2O contg. 0.001% Ag was used. The method of seeding with Ag or Au nuclei was employed. The Au proved more favorable. Hydrazine sulfate or hydrate, formol and H_2O_2 were found suitable reducing agents. Solns. of P in ether were unsuitable because spontaneous nucleus formation takes place too readily. F. L. BROWNE

Platinum hydride hydrosol and its dehydration by metallic mercury. C. PAAL AND CHARLOTTE AUERSWALD. *Ber.* **60B**, 1648 54(1927).—Expts. were made with a Pt colloid protected with Na lysallinate, contg. 33.88% Pt which was readily sol. in H_2O . Hydrosols made with freshly prepd. colloid adsorbed 305 vols. of H_2 per vol. of Pt. On standing in contact with air their adsorptive capacity for H_2 diminished. On shaking a Pt hydrosol satd. with H_2 with 11g. 88 volumes of H_2 per vol. of Pt were given off and a Pt amalgam hydrosol was formed. F. L. BROWNE

A general electrical method for the preparation of organo-metallic hydrosols. EUGÈNE FOUARD. *Colloïdes biol. clin. therap.* **1**, 101-9(1927); cf. *C. A.* **21**, 1577.—An enzyme may be conceived as consisting of a material system adsorbed at the surface of the org. colloid, in the midst of which it exerts its action, and condensed in its perigranular zone, which is the true seat of its activity. Since all chem. transformations in aq. soln. take place exclusively through the action of ions, enzymic reactions are max. for a max. concn. of adsorbed active ions in contact with the colloid. The latter thus acts as ionizer, or condensing agent for ions, and consequently multiplies the rate of the reaction, which could take place in a non-colloidal medium, but at a much lower rate. Beyond a given state of chem. equil. addn. of mol. which can be transformed by the enzyme causes a fresh adsorption by the micelles and upsets the equil., resulting in a reaction in the perigranular zone, with liberation or elimination of the excess of the transformed mol. into the intermicellar liquid. It follows from this conception that a proper understanding of enzymic phenomena is intimately bound up with a thorough knowledge of the mechanism of adsorption by colloids. Investigations along this line led to the development of a method of prepn. previously outlined (*loc. cit.*), which is now described and discussed at greater length. Highly purified amylose was selected as org. colloidal substratum, preferable to an albuminoid, because of greater ease of purification and because the use of the organo-metallic colloids obtained for physiol. and therapeutic investigations does not give rise to colloidoclastic shock experienced with injections of albuminoids. Conditions under which electrolysis must be carried out are discussed, and comprise, among others, as thorough purification as possible of the colloid, which must be perfectly neutral, elimination of the products of electrolysis other than the metal which tend to diffuse throughout the whole of the medium, and reduction of the rate at which the ions are brought to the cathode. The amylo-metallic complex obtained is dispersed as a colored cloud, which is repelled by the cathode and attracted by the anode. Each granule of pure, iso-elec. amylose is, therefore, converted into an amylo-metallic micelle, which behaves as a large negative ion whose charge is balanced by free positive ions, presumably metal ions. The metallo-org. hydrosol micelle would therefore consist of an amylose complex, mol. metallic granules slowly discharged on the amylose and acquiring a characteristic color for each metal, and metallic ions which have retained their elec. charges. With organo-metalloid hydrosols, the elec. charges are reversed. Contrary to the hydrosols obtained by the Bredig method, the products thus obtained can be subjected to thorough purification without danger of changing the initial micellar structure. Use of these hydro-

sols in physiological and therapeutic investigations showed that, when injected intravenously, they do not cause any colloidal shock, the latter being produced with unpurified colloidal substratum and decreasing as the degree of purification increases. This shows that colloidal shock on the one hand and therapeutic and physiological effects on the other are distinct and independent phenomena, and that the latter can be obtained without the former. A PAPINEAU-COUTURE

Colloidal gold in alkali halide crystals. F. BLANK AND F. URBACH. *Naturwissenschaften* 15, 700(1927).—On adding AuCl_3 to fused KCl or other halides colored crystals were obtained. The color appears after solidification and changes on cooling, the final result being dependent upon the rate of cooling and the nature of the salt (KCl red-violet, KBr blue and green, KI yellow). Most intensive coloration appeared at points of strongly disturbed crystal structure. The gold coagulates on dissolving of the salt. The crystals show Tyndall effect and ultramicroscopic particles. B. J. C. v. d. H.

The physical chemistry of dyestuffs. III. Theoretical note concerning my method for determining the charge in dye solutions. REINHOLD FURTH. *Kolloid-Z.* 41, 297-9(1927); cf. *C. A.* 20, 865.—The significance of the studies by Blüh (*C. A.* 21, 2005) of the potential drop along the special electrodes employed in F.'s previously described method is discussed. The optimum length of the electrodes is a compromise between the necessity of keeping them short enough to avoid too great loss of potential and long enough to avoid contamination by electrolytic decomposition products during the expt. IV. A new method for the exact determination of the degree of dispersity of dye solutions. *Ibid* 300-4.

Since charge and degree of dispersity det. the usefulness of dyes for biol. staining (Gieckhorn and Keller, *C. A.* 19, 2217; *Z. wis. Zool.* 127, 244 (1926)), routine methods of measuring both properties are needed. The method for measuring degree of dispersity through observation of diffusion velocity and calcul. on the basis of the Einstein formula is adapted to the purpose within the limits of precision required for biol. work by making the examn. with the microscope over distances of the order of 0.1 mm. instead of several cm. In that way a detn. in quadruplicate can be made in 10 to 20 min. with an accuracy of 3 to 6%. The method requires no elaborate app., technic or precautions against vibration and temp. changes. A detailed description is given of the special *microscope object glass*, easily made from ordinary laboratory equipment, with which observation of the diffusion can be made. Further improvements in the method and a crit. examn. of the technic are reported by E. Ullmann (*C. A.* 21, 1579). V. The degree of dispersity of dyes. REINHOLD FURTH AND ERNST ULLMANN. *Ibid* 304-10.—An acid dye, trypan red, and a basic dye, neutral red, in concns., c , varying from 0.031 to 0.125% were examd. for velocity of diffusion, D , by the method of the preceding abstract. D varied with c , increasing ever more rapidly as c decreased. At infinite diln., D was 4.3×10^{-6} sq. cm./sec. for neutral red (mol. wt. 275) and 3.5 for trypan red (mol. wt. 980). Application of the Einstein formula indicates that for neutral red the radius of the particles, a , is 4.6×10^{-7} cm. at infinite diln. and increases as a linear function of c . For trypan red, a is 5.8 at infinite diln. and increases at higher concn., but the a - c curve is concave downward. The change in a with c must be kept in mind in using dyes for staining biological preps. It is suggested that the dyes are dispersed in the form of single mols. at infinite diln. and polymerize rapidly as c increases. On that basis the particles in concd. solns. of neutral red consist of about 40 mols. For Congo red, D was found to be 1.56×10^{-6} at $c = 0.125\%$, giving $a = 1.26 \times 10^{-7}$. An examn. of aq. soln. of KMnO_4 showed that D varies 3 fold between infinite diln. and 0.5% concn.; the value of D for infinite diln. agrees with the prediction on the basis of Nernst's formula. The influence of electrolytes on D and a can also be investigated by the method employed. F. L. B.

The determination of average size of particles in colloidal solutions by means of v. Smoluchowski's formula. H. J. C. TENDELOO. *Kolloid-Z.* 41, 290-3(1927).—The addn. of KCl to an As_2S_3 hydrosol increased the viscosity to a max., after which it fell off again on further addn. It is suggested that the influence of electrolytes on As_2S_3 sol is of an electrocapillary nature, in accordance with v. Smoluchowski's theory of the quasi-viscous effect. It is possible to compute the av. particle size with the aid of v. S.'s formula provided that the viscosity, the cond., the electrokinetic potential, and the relative vol. are known. F. L. BROWNE

Estimation of the efficiency and dispersive power of emulsifying agents. R. C. SMITH. *J. Soc. Chem. Ind.* 46, 345-6(1927).—Three methods for standardizing the emulsifying power of agents are given. After emulsifying equal quantities of the dispersion medium and disperse phase the quantities of (1) disperse phase remaining undispersed, (2) dispersion medium remaining unused, and (3) the emulsion, are compared. "Emulsifying power" and "dispersion factor" are calcd. from these relative vols. A

third method described¹ depends upon measuring the average radius of the emulsified particle. An appeal is made for the standardization of methods by all experimenters in this field.

J. W. SHIPLEY

Studies in "photo-sols." I. S. S. BHATNAGAR, N. A. YAJNIK AND VASU DEV ZADOO. *Quart. J. Indian Chem. Soc.* **4**, 209-16(1927); cf. *C. A.* **19**, 1647.—Sols of Au and Ag prepd. by Zsigmondy's method and Bredig's method were treated with sols of As_2S_3 and Sb_2S_3 . All sols were negatively charged. The concns. of the sols varied greatly. Sep. tests were made to det. the effects of air and of light on the changes which occur. No changes except coagulation occurred in the dark. Very little change occurred in diffused light. Profound changes of color and composition occurred in direct sunlight. Exposure to air modified some of the changes occurring in sunlight. When the changes are completed, the mixts. contain sulfides of Au or Ag, free sulfur and H_2AsO_3 or H_2SbO_3 . These results are due to the hydrolysis of the sulfides, As_2S_3 and Sb_2S_3 to form H_2S . The action of air and light on H_2S produces H_2O and S. The Au sol or Ag sol reacts with H_2S to form sulfides of Au or Ag. Color changes are due to successive stages in these chem. changes. Probably small quantities of the metal sulfide formed initially in the mixts. form centers of photochem. sensitivity similar to such centers on a photographic film.

F. E. BROWN

Peptization of metallic hydroxides in presence of sugars. M. R. MEHROTRA AND K. C. SEN. *Quart. J. Indian Chem. Soc.* **4**, 117-29(1927); cf. *C. A.* **18**, 490.—The peptization of the hydroxides of Cu, Hg , Fe and Ce in the presence of sucrose, dextrose, levulose and lactose was studied. In one set of expts. the vols. were all 15 cc. and the amt. of NaOH was 3 millimols. Under these conditions the amt. of sugar in millimols, C_s , is represented by the equation, $C_s = AC_m + B$, where A and B are consts. and C_m is the amt. of metallic hydroxide in millimols. The consts. are different for each sugar with each metallic hydroxide, and the concns. of the hydroxides have a lower and an upper limit for each sugar-metallic hydroxide pair outside of which the equation is inapplicable. For dextrose and levulose, the order of peptizability of the hydroxides expressed in mols is $Cu > Fe > Hg > Ce$; for sucrose $Cu > Ce > Fe > Hg$; for lactose $Cu > Fe > Ce > Hg$. With increasing vol. the amt. of sugar necessary to peptize a fixed amt. of a hydroxide decreases until low concns. of metallic hydroxide are reached. A min. excess of alkali is necessary to aid peptization. In one case, Cu, a larger excess of alkali decreases the amt. of sugar required for peptization; in another case, Hg, higher concns. of alkali increased the concn. of sugar required. The excess of alkali is at least as important as the presence of the sugar in inhibiting the pptn. of the metallic hydroxides. However, $Fe(OH)_3$ can be peptized in an acid soln. but not in a neutral soln. F. E. B.

Peptization of iron and chromium hydroxides in presence of nonelectrolytes and the influences of acid and alkali on the peptization. K. C. SEN. *Indian Chem. Soc.* **4**, 131-5(1927); cf. preceding abstr.—The hydroxides of Fe and Cr are peptized by means of glycerol. "The peptization of metallic hydroxides, in general, cannot be obtained unless an excess of alkali is present in the soln." "The nonelectrolytes are not functioning as the peptizing agents in the usual sense of the term and we have to consider the hydroxyl ions as the real peptizing agents in those cases where excess of hydroxyl ions are present." The peptized $Fe(OH)_3$ sol. is positively charged when there is a deficiency of NaOH, and negatively charged when there is an excess of NaOH. The sugar does have some sp. function in the peptization and each sugar has its own sp. power on each metallic hydroxide. F. E. BROWN

• Solution of colloids of large molecular compounds by a very easily soluble strongly hydrolyzed materiál. P. P. V. VEIMARN. *Kolloid-Z.* **42**, 134-40(1927).—Colloids may be divided into 2 classes, one thermodynamically unstable called dispersoids and the other stable called solutoids. A very great difference may be seen between the two for substances of high mol. wt. The dispersion theory, which rests on the assumption that mols. of high mol. wt. are solvated dynamically, is discussed. A general basis is given for the stability of extremely stable dispersoid solns. A review is given of previous work on dispersion of cellulose, fibrin, casein, chitin, keratin, etc., and in order to test further the theory of dynamic hydration V. has studied dispersion and aggregation of casein, silk and cellulose, in pyrogallol and resorcinol. The properties of these colloids are then discussed. R. H. LAMBERT

Aging phenomena of viscosity and conductivity of a sol and an electrolyte. N. R. DHAR AND D. N. CHAKRAVARTI. *Kolloid-Z.* **42**, 120-4(1927).—Sols of $Fe(OH)_3$, Berlin blue, Cu ferrocyanide, stannic acid, As_2O_3 and crystal violet show an increase in cond. and a decrease in viscosity with age, indicating a hydrophobic nature. K soaps are also hydrophobic. Congo red and molybdic acid show an intermediate

state between hydrophobic and hydrophilic sols. Ce nitrate and Ni sulfate show slight increases in cond. with time while stannic acid and $\text{Fe}(\text{OH})_3$ show a great change in viscosity and cond. with age which is greatly accelerated by heating. A study of aging gives a sensitive test for the constitution of colloids. R. H. LAMBERT

The viscosity of a hydrophobic sol and its change on addition of electrolytes. D. N. CHAKRAVARTI AND N. R. DHAR. *Kolloid-Z.* **42**, 124-34 (1927).—The influence of addn. of electrolyte to a hydrophobic sol has been treated by measuring viscosity of a great many sols. Addn. of a common ion is included in the data. In most cases the viscosity passes through a min with concn. of electrolyte. Fe and Al hydroxides are more strongly hydrated than As sulfide sols. Common-ion electrolytes lower viscosity much more than others. Viscosity begins to increase rapidly at concns. of electrolytes far below that necessary for flocculation in consequence of a decrease in the charge and increase in hydration of the sol. R. H. LAMBERT

The action of colloidal and semi-colloidal ferric oxide sol on a gelatin solution in water. R. WINTGEN AND M. VÖHL. *Kolloid-Z.* **42**, 140-9 (1927).—A method is described for prepg. colloidal ferric oxide by an ultrafiltration. Addn. of gelatin causes an increase in amt. of pptn. of chromic oxide sol, passing through a max. at sufficiently high concn. of gelatin. For Fe_2O_3 sols this depends on amt. of HCl present and the concn. of gelatin soln. added. If the sols are added to gelatin soln. a max. pptn. occurs with either a dild. or a concd. sol. The equiv. aggregate wt. of gelatin averages 32,600 as compared to 32,200 for Cr_2O_3 sols. The equiv. aggregate wt. depends on the method of prepn. of the gelatin and may vary as much as 4-fold for different samples of gelatin. R. H. LAMBERT

Effects of colloids on the reaction of media. JEAN LOISELEUR. *Colloides biol. clin. therap.* **1**, 110-22 (1927); cf. *C. A.* **21**, 2588.—Animal parchment which has been placed in contact with a soln. of a neutral electrolyte causes partial hydrolysis of sucrose, the intensity of the phenomenon depending on the nature of the electrolyte (increasing as the soly. of the cation-membrane combination decreases) and increasing with the concn. of the sucrose soln., time (apparently to a limiting value), temp. (expts. carried out at 10-37°) and surface of parchment. Similar expts. in which the parchment was used as a dialyzing membrane gave more marked hydrolysis of the sucrose: max. effect was obtained with the most sol. salts (e. g., NaCl); the degree of hydrolysis decreases with increase in concn. of the electrolyte; and temp. exerts a similar but less marked effect than with immersed parchments. No such effects are obtained with vegetable parchment or collodion membranes. From a discussion of the mechanism of the phenomenon, L. concludes that the hydrolysis is the manifestation of a variation in p_H resulting from selective adsorption of the ions of the electrolyte. Such a phenomenon can come into play in establishing the intracellular p_H of tissues. A. PAPINEAU-COUTURE

The opalescence of certain jellies. PAUL BARY. *Colloides biol. clin. therap.* **1**, 51-3 (1927).—A jelly consists of a single phase, whereas a gel consists of 2 phases. The opalescence observed in demineralized-gelatin jellies under certain conditions is due to the fact that the body is not a simple jelly but must contain a dispersed phase. This may be due to an impurity in the gelatin, or may be explained by assuming that the gelatin is not completely homogeneous but consists of 2 substances having similar chem. properties, but unequal swelling capacities in the solvent used. A. P.-C.

The increase of Brownian movement by means of light. W. POSPISIL. *Ann. Physik* **83**, 735-52 (1927).—It was shown by quant. expts. that the Brownian movement of substances that do not absorb the light employed, such as mastic, remains unchanged regardless of the intensity of the illumination and that it continues in the absence of light. Substances that absorb the light employed, such as carbon and gamboge, under the influence of strong illumination exhibit a greater acceleration of Brownian movement than can be accounted for by the rise in temp. of the liquid and the decrease in its viscosity. The phenomenon is related to photophoresis and radiometry and cannot be explained on the basis of kinetic theory. It can be accounted for either by means of photoelectricity or better on the assumption that mol. motion is a consequence of black-body radiation. F. L. BROWNE

The Hofmeister series. E. H. BUCHNER. *Rec. trav. chim.* **46**, 439-44 (1927).—No really conclusive explanation has as yet been given as to the cause of the Hofmeister or lyotropic series. It is known only that a no. of salts, when arranged according to their influence on different phenomena in colloid. chem., always appear in the same order, which, however, may be reversed as a whole. Expts. were made on the influence of temp. and sol concn. on the concn. of salt which ppts. gelatin from its sol. The detns. were made at 40°, 60° and 80°. The salts investigated, listed in the order of their

decreasing salting-out power, were $K_4Fe(CN)_6$, Na citrate, Na_2HPO_4 , NaF, Na_2SO_4 , Na tartrate, $Na_2S_2O_4$, $Na_2S_2O_8$, $Na_2S_2O_3$, NaOAc, Na formate. The influence of the concn. of the gelatin was in most cases very small, though the tendency was for the more concd. gelatin solns. to be salted out more easily. Except in the case of the acetate the influence of temp. was not very important. The influence of the same and other salts on the swelling of gelatin was measured. It is concluded that the polyhydrol mols. of H_2O have a greater peptizing influence (*i. e.*, greater affinity for) the gelatin micelles than the single H_2O mols.

R. L. DODGE

Mechanical and electrical coagulation. WO. OSTWALD. *Kolloid-Z.* **41**, 71-80 (1927).—The effect observed by Freundlich and Kroch (*C. A.* **21**, 845) that certain colloid systems are coagulated by mechanical stirring is discussed, and their conclusions are criticized. It is considered more likely that the coagulation is due to elec. charges set up by differences of potential between the stirrer and the colloid system. The observations of Freundlich and Kroch can be explained quant. on this basis. B. C. A.

Influence of alcohols on the coagulation of dispersoid solutions. A. JANEK AND B. JIRGENSONS. *Kolloid-Z.* **41**, 40-46 (1927).—A study was made of the effect of methyl, ethyl, propyl and *i*-butyl alcs. on the coagulation of dialyzed sols of $Fe(OH)_3$, Ag and As_2S_3 by electrolytes. When coagulation was carried out by means of NaCl, small amts. of the alcs. sensitized the sols (*i. e.*, rendered coagulation easier), the effect increasing with increasing mol. wt. of the alc. Higher concns. of alcs. stabilized the sols. This effect, although not very noticeable with $Fe(OH)_3$, was easily recognizable with Ag sol and quite pronounced with As_2S_3 . In the case of As_2S_3 , a max. stabilizing concn. was reached, further increase of alc. causing sensitization again. In this case also, MeOH differed from the others in sensitizing throughout. The best stabilizing effect was found in the coagulation of As_2S_3 by $BaCl_2$, with small quantities of alc. In this case also, MeOH exerted a sensitizing effect, and at higher concns. EtOH did likewise.

B. C. A.

Lyotropic properties of the fluoride ion. H. FREUNDLICH AND M. ASCHENBRENNER. *Kolloid-Z.* **41**, 35-40 (1927).—The F^- ion is regarded as the extreme end of the Hofmeister series. The exptl. data on which this conclusion rests are the following effects, due to the presence of fluorine ions: (1) the lowering of the soly. of highly sol. substances, (2) the large increase of surface tension at a water-air interface, (3) the change in the electropotential at a water-air interface, (4) the favorable influence on the sol-gel transformation of a gelatin soln. F^- ions have a strong coagulative effect on the weakly hydrophilic colloid $Fe(OH)_3$, but a weaker effect than the Cl^- ion on the hydrophobic CuO sol.

B. C. A.

Effect of acids on hydrophobic colloids, particularly gold. W. PROSCH. *Kolloid-Z.* **40**, 318-21 (1926).—A lecture on the influence of H^+ -ion concn. on the pptn. of colloidal Au and on the inhibitive effect of protective colloids.

B. C. A.

Flocculation and deflocculation of the silver halides. S. E. SHEPPARD AND R. H. LAMBERT. *Fourth Colloid Symposium Monograph* 1926, pp. 281-301 (Chem. Catalog Co.).—Following discussion of coagulation and recrystn. in the grain growth of Ag halide ppts. (partly polemical against F. F. Renwick), evidence is given to show that coagulation by electroadsorption is a phase of Ag halide pptn., in agreement with Lottermoser. The process is not purely a recrystn., as suggested by Jabczyński. Gelatin inhibits coagulation as a result of electroadsorption, its higher concn. increasing the total reactant concn. at which flocculation is possible. Electrocoagulation and recrystn. follow initially the same law for the diminution of number of particles. Electrocoagulation and recrystallization play only a subordinate role in grain growth in Ag-Br emulsions.

JEROME ALEXANDER

Charge on the particles in colloids. R. WINTGEN. *Kolloid-Z.* **40**, 300-2 (1926).—The amt. of colloidal substance deposited by one Faraday of electricity may be regarded as the electrochem. equiv. of the colloid, and colloids may therefore be expressed in terms of normality, according to the no. of electrochem. equivs. of colloid per l. This value may be detd. by measuring the elec. cond. of the system before and after ultrafiltration, the difference representing the cond. due to the charged colloid particles. Results are given for sols of Fe_2O_3 and for dialyzed and undialyzed Au sols.

B. C. A.

Changes in electrical conductivity of electrolytes and sols with age. N. R. DHAR. *Z. anorg. allgem. Chem.* **162**, 237-42 (1927).—The speed of hydrolysis of salts of difficultly sol. acids or bases depends upon the speed of formation of nuclei and of coagulation of the latter to colloid particles. Such colloids gradually lose their activity, absorptive capacity and H_2O , so that absorbed electrolyte is given up and cond. is increased. Hydrophilic colloids such as gelatin and egg albumin, with age increase

in stability, degree of hydration, viscosity and absorptive capacity, and decrease in elec. cond. and surface tension. Age has the opposite effect upon hydrophobic colloids.

A. W. FRANCIS

Diffusion-potential measurements applied to hydrochloric acid-gelatin systems. I. The equivalent weight of gelatin. A. L. FERGUSON AND E. K. BACON. *J. Am. Chem. Soc.* **49**, 1921-34 (1927).—An app. is devised for detg. the liq./liq. junction potentials of 0.1 N HCl/0.01 N HCl, and HCl/NaCl and HCl/gelatin at various concns. The results are reliable and accurately reproducible. Curves of the relations between changes in diffusion potential at the boundaries of HCl/gelatin with varying gelatin concns. are similar to the corresponding curves for HCl/NaCl. From the 4 points of inflection in the gelatin curves the equiv. wt. is detd. to be 1090. These show that the combinations between gelatin and 0.01-0.10 N HCl are in stoichiometric proportion.

II. The components of hydrochloric acid-gelatin solutions. EGBERT K. BACON AND ALFRED L. FERGUSON. *Ibid* 1934-9.—Dissimilarities, in the previous expts., in the potential curves of HCl/gelatin and HCl/NaCl are due to the addn. of gelatin irrespective of the amt. needed for complete combination with HCl. A largely indeterminate source of e. in. f. is thus formed at the boundary. The solns. should be defined in terms of the free acid and combined and uncombined gelatin. An excess of this has no effect. To explain the results satisfactorily the neutral iso-electric gelatin is assumed to form the highly ionized gelatin chloride, giving Cl anions and gelatin cations.

J. BALOZIAN

Cataphoresis, electrical charge, critical potential and stability of colloids. H. R. KRUYT, A. C. W. ROODVOETS AND P. C. VAN DER WILLIGEN. *Fourth Colloid Symposium Monograph* 1926, pp. 304-10.—Cataphoresis measurements with Burton's app. with an As_2S_3 sol, using intermicellar fluid, show that the rate of cataphoresis increases with addn. of KCl in all concns. nearly to flocculation. Recent investigations in dielec. potential show that addn. of electrolyte causes fall in potential and that the rate of cataphoresis ζ does not necessarily vary in the same sense as fall of potential ζ . Since the crit. potential does not depend on a definite u value, but on u/D , there is no reason to reject the theory of crit. potentials.

JEROME ALEXANDER

Electrocapillary phenomena and ions. W. KOPACZEWSKI AND M. ROSNOWSKI. *Compt. rend.* **185**, 450-3 (1927).—Different ions, anions or cations, can effect a reversal of the direction of electrocapillary penetration of colloids or at least increase or decrease the rise. Ferric ion has such a marked effect that at a concn. of only 10^{-6} molal it will cause a positive colloid whose penetration is feeble to rise in filter paper as high as a negative colloid. Anions act especially on positive colloids. H ion has a marked influence on the rise but the anion of the acid also has a simultaneous effect.

E. R. SMITH

The physical chemistry of dyes. II. The technical presentation of the Furth method of determining the electric charge of a dye solution together with a collection of demonstration experiments. JOSEF GLICKLHORN. *Kolloid-Z.* **42**, 9-18 (1927).—An outline is given for the qualification necessary for the porous material used in the Furth method for detg. the elec. charge on dyes in soln. The method is especially applicable to biological expts. Expts. were made by using both paper and sintered-glass filters. Gypsum, wood and many other materials are considered for the same purpose. The efficiency and advantage of the procedure are illustrated by a demonstration expt. that is recommended. This expt. affords an easy method for studying elec. relations of colloid and soln.

R. H. LAMBERT

The macroscopic method of measuring the velocity of migration of colloid particles. A. F. GERASIMOV. *J. Russ. Phys.-Chem. Soc.* **58**, 601-9 (1926).—The migration velocity of dialyzed collargol was measured according to Burton; solns. of Na_2SO_4 , Na_2CO_3 and NaOH of cond. approaching that of the sol served as the electrolytes. The tube was 2.6 cm. wide and at the p. d. of 0.5 v. per cm. and current of 0.8 milliamp., the distortion of the meniscus was negligible. Readings were made with the aid of a cathetometer or a microscope and a suitable light filter (a soln. of Me green). The speed of migration increases during the first 15-20 min., then remains const.; it varies widely with the nature of the electrolyte used, and subsequent measurements with the same electrolyte deviate by 7.4%. A correction for the diffusion of the sol did not improve the results. The method is theoretically sound only when applied to very dil. sols and a large excess of the electrolyte, its concn. being the same inside and outside of the sol. It is not in general capable of quant. precision.

BASIL C. SOVENKOFF

The velocity of cataphoretic migration of coarser particles in sols and gels. H. FREUNDLICH AND H. A. ABRAMSON. *Z. physik. Chem.* **128**, 25-38 (1927).—On measuring the velocity of cataphoretic migration of Zn dust particles suspended in 1%

gelatin sol during the change from sol to gel (requiring several hours) it was found that the velocity remains const. within exptl. error. The velocity increases in proportion to the potential gradient, in accordance with the assumption of a const. and relatively small coeff. of viscosity. The gel became sufficiently solid, however, to prevent settling of the particles under the influence of gravity. The metal particles in the sol do not seem to move independently but appear to be attached to gelatin particles and to serve as indicators of the motion of the otherwise invisible gelatin particles. That condition was evidenced by the facts that other suspended particles, such as air bubbles, moved with the same velocity and that the movement became zero and reversed direction on passing through the isoelec. point. The gelatin particles then migrate with the same velocity in the solid gel as in the fluid sol. It is suggested that the elasticity of the gel may be due to the binding together of part of the gelatin particles to threads, disks, etc., which govern the macroscopically observed mechanical properties of the gel. Microscopic observation of cataphoresis, on the other hand, reveals other particles, not so bound into threads, which move with the same freedom in gel as in sol. The erythrocytes of horse blood are always negatively charged and move in the blood serum at room temp. with a velocity of 1.01μ per sec. per v. per cm. Erythrocytes that have clumped together move with the same velocity. The white corpuscles are also negatively charged. The leucocytes migrate 50% more slowly, the lymphocytes 30% more slowly than the erythrocytes. Again, clumping of the corpuscles failed to alter the migration velocity. The apparent contradiction between these observations and the theory of Debye and Hückel may be due to distortion of the elec. double layer about the particles under the influence of the applied potential. F. L. B.

The distribution of hydrogen ions between gelatin and water. I. I. ZHUKOV, S. A. SHCHUKAREV AND I. N. BUSHMAKIN. *J. Russ. Phys.-Chem. Soc.* **58**, 639-58 (1926).—Numerous electrometric titrations of acids were made in presence of varying amts. of gelatin of 1.3% ash content. The curves intersect at p_H 5.6 (isoelec. point). For a given p_H , the amts. of H and OH ion combined with a g. of gelatin were independent of the concn. of the protein. At p_H 2, 1 g. of gelatin combined with 9.2×10^{-4} g. of H ion (9.1×10^{-4} according to Loeb) and at p_H 3, 7.8×10^{-4} g., while at p_{OH} 3 only 4.9×10^{-4} g. of OH ion is absorbed. Expts. with a different batch of gelatin showed its isoelectric point to lie at p_H 5.25 irrespective of the nature of the electrolytes present or their ionization const. The above observations contradict the view of gelatin as an ampholyte forming easily hydrolyzable salts. BASIL C. SOYENKOFF

Collodion membranes. I. Preparation of uniform membranes and their characterization. NIELS BJERRUM AND ERICH MANEGOLD. *Kolloid-Z.* **42**, 97-112 (1927).—A description is given for prepg. both cylindrical and flat sheets of collodion membranes that are surprisingly uniform in thickness and porosity. They are readily reproducible as to thickness, water content per cc. of membrane and porosity to water. The product of porosity and thickness of membrane of const. vol. is const. if evapn. of collodion soln. takes place in a dry air atm. If the collodion infusion is exposed to air satd. with water or even better to acetone, a membrane will be obtained whose porosity is much greater even though its thickness is the same as that of the other. R. H. L.

The function of carbon membranes in osmosis. F. E. BARTELL AND H. J. OSTERHOFF. *Fourth Colloid Symposium Monograph* 1926, 234-45 (Chem. Catalog Co.).—The function of membranes in osmosis is not elucidated by thermodynamic treatment. Following a discussion of semipermeability and past work on it, expts. are described with membranes made by compressing finely divided silica and C to 2500-20,000 lbs. per sq. in. With silica the flow was from water to org. liquid; with C eventually the reverse. Though the thermodynamic tendency is for a flow from water to org. liquid, in some cases the membrane properties may alter or reverse this. A displacement cell is described, wherein 2 liquids are sepd. by a membrane (SiO_2 or C), with a manometer to indicate the pressure resulting when one displaces the other. The following liquids drove out water from a C membrane, giving the pressures mentioned: Toluene, 2670 mm. Hg; CCl_4 , 2840; pyridine, 750 mm. H_2O ; acetone, 295; propyl alc., 1.92; EtOH, 180. With a SiO_2 membrane, water drove out the following: Toluene, 1360 mm. H_2O ; CCl_4 , 2210; pyridine, 15; propyl alc., 16. With a C membrane, CCl_4 drove out toluene (pressure of 190 mm. H_2O), pyridine, and propyl alc. (pressure 386 mm. H_2O); toluene drove out PrOH (pressure 139); and pyridine drove out PrOH (pressure 556). It is concluded, in conformity with generally accepted views, that in a strictly semipermeable membrane, one component is adsorbed to the practical exclusion of the other. Where the membrane has greater permeability, i. e., with fine pores, the initial osmotic force and direction of flow are mainly detd. by relative adsorption of the liquids, the membrane playing an active part. If the membrane is fairly permeable and thin

enough, osmotic flow is governed by properties of the liquid system, and the membrane may not direct its direction. JEROME ALEXANDER

Observations on anomalous osmosis through collodion membranes. P. J. JURISIC. *Physik. Z.* 27, 774-8(1926); cf. *C. A.* 15, 2041, 2686; 14, 187, 1246, 2285, 2573.—J. Loeb has demonstrated in a number of papers published in 1919 and 1920 that solns. of salts with univalent cations such as $\text{Na}_4\text{Fe}(\text{CN})_6$, Na_2SO_4 , KCl , etc., show a characteristic anomalous behavior, since the quantity of water transported through the collodion membrane in a definite time does not depend only upon the concn. of salt (within certain concns.) in disagreement with osmotic laws. Different conditions have been observed by Loeb when salts with cations possessing a higher valency were used. Loeb's findings have been corroborated by Preuner (cf. *C. A.* 17, 2072). In contrast to L.'s and P.'s observations it has been found by J. that the anomaly in the osmotic behavior is of an altogether different nature from the one observed by L. and P. The osmotic pressures are higher than those observed on isotonic solns. of glucose. J. has found in contrast to P. that there is no regular relation between the potential and the salt concn. Varying results have been obtained with various collodion membranes. Addn. of acid retards the transference of water, alkali accelerates it at concns. of from $M/32$ down. Between $M/32$ and $M/64$ a retardation takes place. E. K.

The electroendosmosis of aqueous solutions through a diaphragm of sintered glass powder. FRED FAIRBROTHER AND HAROLD VARLEY. *J. Chem. Soc.* 1927, 1584-9.—Electroendosmosis expts. were carried out with a diaphragm of sintered Jena glass powder in H_2O and dil. HCl . The app. was essentially that described by Fairbrother and Mastin (cf. *C. A.* 19, 771). The amt. of electroendosmosis decreased after a time, and in 0.01 N HCl it reversed in direction. Expts. were also carried out on the permeability of the diaphragm to H_2O . This also decreased with time. The results indicate that the glass surface undergoes a swelling process. The distribution of potential within the swollen layer may account for the reversal of direction. R. L. D.

The osmotic pressure of solutions. M. K. LEVANT-EZERSKII. *J. Russ. Phys.-Chem. Soc.* 57, 151-60(1925); *Chem. Zentr.* I, 1926, 2656; cf. *C. A.* 19, 2155.—From a study of the literature it is concluded that the osmotic pressure, the vapor pressure and the lowering of the f. p. are actually proportional to one another, and the hypothesis is accepted that these values are proportional to the concn. of the soln. C. C. D.

Behavior of difficultly soluble metal oxides in solutions of their salts. Magnesium oxide cements. W. FEITKNECHT. *Helv. Chem. Acta* 10, 140-67(1927); cf. *C. A.* 21, 3169.—The formation of solid masses or cements from mixts. of MgO and MgCl_2 soln. was studied. There is a sharp break in the dehydration curve at 6 mols. of H_2O to one of MgCl_2 . When kept under a concd. soln. of MgCl_2 the cement sample takes up MgCl_2 slowly and the final product contains more than 1 mol. MgCl_2 to 1 mol. MgO . The strength of the cement increases with increased concn. of MgCl_2 . The strength is in a complex manner dependent on the subdivision of the materials; fine-grained oxide gives a hard mass. With other Mg salts the order of decreasing hardness is: chloride, bromide, sulfate and nitrate. On drying the cement the strength does not vary much with progressive loss of H_2O . Dehydration quickly decreases its strength below its original value. Drying at a high temp. increases the strength up to a certain point. The beginning of the decrease in strength is in no stoichiometric relation to the H_2O content of the cement, but is rather limited to a morphological relationship. Microscopic investigation shows that in the normal setting of the cement no crystd. oxychloride is formed, but the strength arises from the penetration of the soln. into the inner MgO grains, where a chem. reaction occurs, whereby the grains expand until they touch one another and are then knitted together. M. FENSKE

Solubility of the silver halides in concentrated halide solutions. L. DRBE AND TH. WALTHER. *Z. anorg. allgem. Chem.* 163, 185-94(1927).—The soly. of AgCl and AgBr in one equiv. of solvent was detd. In the following, the soly. is given in millimols. of AgCl or AgBr . The solvent is indicated first; the four following figures refer to the soly. at 20, 40, 60 and 80° resp. (1) *Soly. of AgCl :* $\frac{1}{2} \text{CaCl}_2 + 5\text{H}_2\text{O}$, 4.52, 5.96, 7.57, 9.81; $\text{LiCl} + 5\text{H}_2\text{O}$, 2.85, 4.19, 5.77, 7.91; $\text{NH}_4\text{Cl} + 10\text{H}_2\text{O}$, 1.978, 2.91, 4.22, 6.10; $\text{NaCl} + 10\text{H}_2\text{O}$, 1.271, 1.913, 2.88, 4.41; $\frac{1}{2} \text{CaCl}_2 + 10\text{H}_2\text{O}$, 1.096, 1.607, 2.41, 3.55; $\text{LiCl} + 10\text{H}_2\text{O}$, 0.636, 1.087, 1.775, 2.83; $\text{HCl} + 10\text{H}_2\text{O}$, 0.599, 0.959, 1.514, 2.285; $\text{KCl} + 20\text{H}_2\text{O}$, 0.416, 0.733, 1.309, 2.25; $\text{NH}_4\text{Cl} + 20\text{H}_2\text{O}$, 0.386, 0.683, 1.185, 2.075; $\text{NaCl} + 20\text{H}_2\text{O}$, 0.269, 0.504, 0.938, 1.668; $\frac{1}{2} \text{CaCl}_2 + 20\text{H}_2\text{O}$, 0.248, 0.457, 0.841, 1.449; $\text{LiCl} + 20\text{H}_2\text{O}$, 0.171, 0.360, 0.712, 1.304; $\text{HCl} + 20\text{H}_2\text{O}$, 0.175, 0.349, 0.663, 1.200; $\text{KCl} + 30\text{H}_2\text{O}$, 0.176, 0.368, 0.721, 1.365; $\text{NH}_4\text{Cl} + 30\text{H}_2\text{O}$, 0.183, 0.367, 0.709, 1.321; $\text{NaCl} + 30\text{H}_2\text{O}$, 0.139, 0.291, 0.593, 1.119; $\frac{1}{2} \text{CaCl}_2 + 30\text{H}_2\text{O}$, 0.133, 0.273, 0.548, 1.042; $\text{LiCl} + 30\text{H}_2\text{O}$, 0.100, 0.228, 0.481, 0.955; $\text{HCl} +$

30H₂O, 0.099, 0.226, 0.461, 0.903. (II) *Soly. of AgBr: KBr + 10H₂O, 22.17, 24.06, 27.17, 31.81; $\frac{1}{2}$ CaBr₂ + 10H₂O, 9.37, 11.09, 13.18, 16.01; HBr + 10H₂O, 6.86, 8.11, 9.72, 12.15; KBr + 20H₂O, 3.04, 3.78, 4.94, 6.75; $\frac{1}{2}$ CaBr₂ + 20H₂O, 1.663, 2.23, 3.19, 4.47; HBr + 20H₂O, 1.312, 1.870, 2.70, 3.94; KBr + 30H₂O, 1.068, 1.521, 2.24, 3.34; $\frac{1}{2}$ CaBr₂ + 30H₂O, 0.663, 1.021, 1.600, 2.51; HBr + 30H₂O, 0.605, 0.913, 1.496, 2.31.*

A. L. HENNE

Solubility of solids at low temperatures. W. JACEK. *Rocz. Chem.* **6**, 501-9 (1926).—The soly. of I in pentane, isopentane, and CCl₄ is very small at temp. of about -100° (0.018% in pentane at -71°, 0.017% in isopentane at -79°, and 0.148% in CCl₄ at -24°). At these low temps., the I solns. are colorless, probably because of the formation of an unstable compd. between I and the solvent. The soly. of S in CCl₄ and in toluene was also detd. In all cases, the soly. s agrees with $d \log s = \theta dt$, where θ is const. for the given solvent and solute.

B. C. A.

The velocity of solution. A. E. MAKOVETZKIĬ. *J. Russ. Phys.-Chem. Soc.* **58**, 726-8 (1926).—Expts. with NaCl and CuSO₄ · H₂O in water show the velocity to be proportional to the active mass of free water a and surface of the solid O , or $dx/dt = KOa$.

BASIL C. SOYENKOFF

Viscosities, electrical conductivities and specific volumes of acetic acid-stannic chloride solutions. J. D. STRANATHAN AND JOHN STRONG. *J. Phys. Chem.* **31**, 1420-8 (1927).—Data were taken at 25.2°. The sp. cond. of the AcOH was about 4×10^{-8} and the sp. cond. of the SnCl₄ was about 2×10^{-9} . Both pure substances and 12 solns. whose molal fraction of SnCl₄ varied from 0.0244 to 0.411 were used. The abs. viscosity of AcOH is 0.01155, and of pure SnCl₄ is 0.0084. The viscosity increased with increasing concn. of SnCl₄ until its molal fraction was 0.2527 when the max. was reached. The abs. viscosity at this concn. was 3.034. The abs. viscosity then decreased to 0.4234 when the molal fraction of SnCl₄ was 0.411. The sp. vol. varied continuously from 0.9486 for pure AcOH to 0.4436 for pure SnCl₄. The sp. elec. cond. decreased from 11.85×10^{-4} for the soln. whose molal fraction of SnCl₄ was 0.0244 to 2.510×10^{-4} for the soln. whose molal fraction of SnCl₄ was 0.4111. The mixing of SnCl₄ and AcOH is accompanied by large evolution of heat and a contraction of as much as 32.10% of the additive vol. The max. viscosity is 282 times that calcd. from the additive law, and 263 times that of the most viscous component. The max. is at the compn. represented by SnCl₄·3AcOH, and indicates the existence of this compd.

F. E. B.

The density of solutions of sodium in liquid ammonia. C. A. KRAUS, E. S. CARNEY AND W. C. JOHNSON. *J. Am. Chem. Soc.* **49**, 2206-13 (1927).—The ds. of solns., ranging in concns. from 32.6 mols. of NH₃ per atom of Na to satn., are detd. at -33.8° with a modified Westphal balance in a II atm. They are found to vary from 0.5782 for a satd. soln. to 0.6582 and are less, in any case, than that of either constituent. The vol. change is calcd. by a formula from the data. For a satd. soln. the change is 40.96 cc.; on dilg. to 16.2 mols. NH₃ per atom of Na it has a max. value of 43.14 cc., and on further diln. approaches 40 cc. From a plot of equl. pressures of solns. of Na in liquid NH₃, in mm. of Hg, against concns. in mols. of NH₃ per atom of Na, the satd. soln. is found to contain 5.18 mols. of NH₃ per atom of Na.

J. BALOZIAN

Bromine as a solvent in the electrochemistry of non-aqueous solutions. V. FINKELSTEIN. *J. Russ. Phys.-Chem. Soc.* **58**, 565-86 (1926). (cf. C. A. **20**, 3377. B. C. S.)

The influence of temperature on the neutral salt effect. A. WEISSBERGER. *Z. physik. Chem.* **126**, 127-32 (1927).—W. replies to objections of Schmid and Olsen (cf. C. A. **21**, 519) that the non-dependence of the neutral salt effect upon temp. and the explanation of this effect as a dehydration of the acid are incompatible, by a short discussion of the dehydration theory in general and in the special form given by Bjerrum.

R. L. HERSCHEY

Influence of electrolytes on the solubility of other electrolytes in non-aqueous solvents. C. A. KRAUS AND R. P. SEWARD. *Trans. Faraday Soc.* **23**, 488-91 (1927).—The soly. of a salt (NaCl or NaBr) in a non-aq. solvent (Me₂CHOH or MeAc) is depressed by a 2nd salt with a common ion, and increased by a salt without a common ion. These effects are less than those in H₂O, but much greater than would be predicted by the Debye-Huckel theory. To apply the latter to solns. of lower dielectric const. the assumption must be dropped that the only mol. species are the simple ions.

A. W. FRANCIS

Mixed solutions of electrolytes and nonelectrolytes. GEORGE SCATHARD. *Trans. Faraday Soc.* **23**, 454-62 (1927); cf. C. A. **21**, 1216, 1913.—By rigorous math. calcs. a complex formula for $\partial F/\partial n_i$ based on the radii and nearest approach of ions and mols. and the dielec. const. of medium was derived. This was compared with observed results in various solns. Agreement is evidence for no solvation of NaCl or KCl in

H₂O-EtOH; but H⁺ and sucrose are evidently hydrated. The generality of the formula is shown by the agreement with observations on such dissimilar solutes as O₂ and egg albumin. Reciprocals of ionic radii are nearly additive. A. W. FRANCIS

The influence of hydrogen and hydroxyl ions on the movement of water through collodion membranes. P. J. JURGIĆ. *Biochem. Z.* **185**, 423-6(1927).—Expts. are cited showing that there is no direct relationship between the H- and OH-ion influence and the p. d. S. MORGULIS

The effect of pressure on chemical reaction. F. E. BROWN. *Proc. Iowa Acad. Sci.* **33**, 145-50(1926); cf. *C. A.* **20**, 2271.—A review and discussion of the work and theories of P. W. Bridgman (*C. A.* **6**, 1084; **8**, 3160; **17**, 3815; **18**, 1219); G. Tammann (*C. A.* **4**, 2059); G. Tammann and H. Diekmann (*C. A.* **20**, 1169); Wm. R. Hainsworth and Duncan A. MacInnes (*C. A.* **16**, 1901); Wm. R. Hainsworth, H. J. Rowley and D. A. MacInnes (*C. A.* **18**, 2628); and B. H. Hite, West Va. Agr. Expt. Sta., J. A. Burrows and the author (*C. A.* **20**, 2627) have shown that suitable mixts. of KClO₃ decompose almost explosively at temps. below 300°. H. M. McLaughlin with the author has shown similar mixts. under 300 atm. pressure may be heated for several hrs. at 320° with less than 10% decompn. The calcd. equil. pressure in this case is 10¹⁵ atm. Increased pressure does not reverse the reaction so that 300 atm. is not an equil. pressure. W. G. GAESSLER

Regions of reaction. X. Fe-S-SiO₂, Fe-Mg-S and Fe-Al-S. W. P. JORISSEN AND B. L. ONGKIEHONG. *Rec. trav. chim.* **45**, 540-4(1926); cf. *C. A.* **21**, 1215.—Reaction regions have been observed for mixts. of solid substances resembling those obtained with gaseous mixts. (cf. *C. A.* **20**, 1549). Data are given, and expressed graphically for the limits of compn. within which reaction takes place for the following mixts.: Fe and S; Fe, S and silica; Mg and S; Fe, Mg and S; Fe, Al and S. B. C. A.

Regions of reaction. XIII. The influence of the size of particles of the reacting substance and of the nature of the igniter. W. P. JORISSEN AND C. GROENEVELD. *Rec. trav. chim.* **46**, 47-53(1927)(In English).—The authors in continuing their work (cf. preceding abstr.) on the regions of reaction of solids (I) Fe-S, (II) Al-S, (III) Al-Fe-S, have substituted a powerful igniter consisting of fine Al (*pulv. subtil*) and flowers of S in the ratio 2.3 g. atoms. This is ignited by Mg ribbon. A larger region of reaction is obtained. The limits in (I) Fe 45.4%-S 54.6%, Fe 86.7%-S 13.3% (all ratios in %); (II) no reaction; (III) Al 5-Fe 36.3-S 58.7, Al 5-Fe 81.3-S 13.7; Al 50-Fe 1.9-S 48.1, Al 50-Fe 9.6-S 40.4 (mixts. in (III) with Al content 5-50% varying by 5% were investigated). When Al (*pulv. subtil*) was substituted in the reaction mixt. for the coarse variety—ignition by Mg ribbon only—both the upper and lower limits with respect to Fe were usually extended. The limits in (II) Al 22.1-S 77.9, Al 74.6-S 25.4; (III) Al 5-Fe 33.8-S 61.2, Al 5-Fe 80.4-S 14.6; Al 50-Fe 34-S 16. Mixts up to 70% Al were studied. In the region 5-20% Al irregularities occur which may be due to the distribution of the component occurring in smallest amt. over the other two. E. R. SCHIERZ

Regions of reaction. XIV. A closed reaction region. W. P. JORISSEN AND C. GROENEVELD. *Rec. trav. chim.* **46**, 369-72(1927); cf. preceding abstr.—Reaction is propagated in mixts. of Al, SiO₂ and S when the comps. lie within the area between 10-54% SiO₂, 13-35% S and 17-66% Al. XV. The influence of carbon dioxide and carbon tetrachloride vapor on the inflammability of a methane-air mixture. W. P. JORISSEN AND G. M. A. KAYSER. *Ibid* 373-7.—A lower concn. of inhibitor is required to prevent explosion of CH₄-air mixts. when the inhibitor is a mixt. of CO₂ and CCl₄ than when it is either CO₂ or CCl₄ alone. With exptl. conditions such that the explosive region of CH₄-air mixts. lay between 6.3 and 12.2% CH₄, 9% CO₂ or 6.4% CCl₄ was necessary to prevent explosion in a 9% CH₄-air mixt. In a mixt. of CO₂ and CCl₄ contg., for example, 40% CCl₄, only 4.5% was required. J. E. SNYDER

Some investigations of the ethyl alcohol-carbon tetrachloride system. S. F. CALHOUN AND THOS. C. POULTER. *Proc. Iowa Acad. Sci.* **33**, 169(1926). An abstract.—The EtOH-CCl₄ system has been investigated with respect to the total vapor pressure, and the partial vapor pressures of the constituents at 25 and 60°. The total pressure of different mixts. of EtOH and CCl₄ were detd. at 25° by means of a bulb to which was sealed a manometer. The total pressure at 60° was measured by means of an app. designed by the authors for the rapid and accurate detn. of the vapor pressures of liquids that do not readily react with Hg. The partial pressures were detd. from the mol. fraction of each constituent in the vapor. The mol. fractions of each constituent in the vapor were detd. by condensing a small amt. of vapor and detg. its d. Curves were plotted for each temp. representing the total and partial pressures. W. G. GAESSLER

Balancing of oxidation-reduction equations. II. E. R. GETTE AND V. K. LAMER. *J. Chem. Education* **4**, 1158-67(1927); cf. *C. A.* **21**, 13145. E. H.

The computation of partial molal quantities of binary solutions. BENJAMIN SORNICK. *J. Am. Chem. Soc.* **49**, 2255-7(1927).—A method is developed that is particularly useful where great accuracy is desired. J. H. PERRY

Amphoteric hydroxides, their aqueous solutions and crystallized salts. V. Relation between the diffusion coefficients and optical absorption in tungstate solutions of various hydrogen-ion concentrations. HERMANN SCHULZ AND GERHARD JANDER. *Z. anorg. allgem. Chem.* **162**, 141-8(1927).—The diffusion coeff. of 0.1 *N* Na_2WO_4 was observed in various aq. solns. at temps. near 10° and corrected to 10° and 25° and also for viscosity. The coeff. was nearly the same for dil. and *N* NaOH and NaNO_3 and NaCl as for pure H_2O , but was decreased to about 0.4 its value in 0.1 *N* HCl or HNO_3 either alone or with *N* neutral salt. This was ascribed to aggregation of ions, e. g., to $\text{W}(\text{WO}_4)_6^{4-}$, just as CrO_4^{2-} goes to $\text{Cr}_2\text{O}_7^{2-}$ in acid soln. It was proposed to prepare complex polytungstates in this way. An 0.1 *N* Na_2WO_4 soln. in 0.1 *N* NaOH showed practically no absorption even in the extreme ultra-violet. A neutral soln. showed ultra-violet absorption, and in 0.1 *N* HCl soln., the absorption was in the visible field. The increase in wave length of absorbed light is analogous to that in chromate solns. A. W. FRANCIS

The mechanism of the electrolytic conductivity in crystals. A. REIS. *Z. Physik* **44**, 353-8(1927).—Ions of only one kind possess an appreciable mobility in electrolytically conducting crystals. This exptl. fact is to be assigned to a deformation of the ions. It is not necessary to consider a deformation of the ideal cryst. lattice. The ions are able to change their position, when they are not stopped by the unilateral attraction of a neighbor. Strongly deforming ions can fasten easily deformed ions. The reverse is not true. A. L. HENNE

The conductivity of acids and salts in liquid ammonia. F. A. SMITH. *J. Am. Chem. Soc.* **49**, 2162-7(1927).—Expts. at -33.5° to det. whether or not certain metallic acid salts derived from the NH_3 system ionize more than the respective acids in liquid NH_3 solns. The cells used are described by Elsey (*C. A.* **15**, 458). The results are accurate to at least 5%. From exptl. data, curves of Λ , the mol. cond., against $\log \Lambda$, the diln. in l. per mol., are made for the compds. Those of the acid amides, the polymers of cyanamides and triphenylguanidine are not plotted because of their small cond. In every case, but one, the alkali metal salt is a better conductor than the corresponding acid. The cond. of the ammonio-carbonic acids and their alkali salts increases with deammonation of the acids and decreases with their polymerization. J. BALOZIAN

The neutral salt effect in ionic reactions. I. The specific ionic effect. A. v. KISS AND V. BRUCKNER. *Z. physik. Chem.* **128**, 71-86(1927).—The effects of the chlorides of K, Na, Li, NH_4 , Mg and Ca, the sulfates of K, Na, Li, NH_4 , Co, Cd, Mn, Mg and Zn, $\text{Mg}(\text{NO}_3)_2$ and HCl , HNO_3 and H_2SO_4 on the ionic reaction between $\text{S}_2\text{O}_8^{2-}$ and I^- were studied in order to test the theory of neutral salt effect proposed by Brönsted (*C. A.* **19**, 2401). The theory was confirmed except for bivalent cations, which do not follow Brönsted's rule. Of the univalent cations K ion has the greatest effect and Li ion has the smallest. With the univalent metals chloride has the greatest and sulfate the smallest salt effect. With univalent ions the effect is greater the greater the ionic vol. With the salts of K, Na and Li there was found to be a qual. dependence between ion effect and viscosity, the more viscous solns. having smaller effects. E. R. SMITH

Contribution to the knowledge of electrolytic solution forces and of the electrolytic ionic condition. P. KARL FREDENHAGEN. *Z. physik. Chem.* **128**, 1-24(1927).—The soln. tension order of the halogens toward NH_3 is the reverse of their order toward H_2O . The NO_3 group has about the same soln. tension toward NH_3 and H_2O . The OH group has only a very small soln. tension toward NH_3 . All metals have a much smaller soln. tension toward NH_3 than toward H_2O . Toward HF the metals and the majority of anion forming elements and groups have greater soln. tensions than toward H_2O . MeOH conducts in HF like a moderately strong acid. The cause of this cond. was shown to be due to an electrolytic dissociation of MeOH. The halides liberate the corresponding halogen acid when added to HF. Dry HCl , CO_2 and CO do not increase the cond. of pure HF. For solns. of H_2O and MeOH in HF the change in cond. with concn. was detd. Pure HF was dried until its sp. cond. was reduced to 0.4×10^{-4} in contrast with the previously accepted value of 269.9×10^{-4} . The dielec. const. of this pure acid was 174.8 at -73° and 83.6 at 0°. Although HCN has the greatest dielec. const. it has only a very slight ionizing power to form electrolytic solns. KCN, KCl and KNO_3 are but slightly sol. in HCN and their relatively large cond. in HCN

is due to large migration velocities. Soln. tensions toward HCN are much smaller than toward alcohols and NH_3 . The dielec. const. does not det. the dissolving and ionizing power of a solvent. Whether or not a solvent can form an electrolytic soln. with a given compd. depends on sp. interactions between solvent and dissolved compd. II. *Ibid* 239-65.—From thermodynamic considerations the conclusion is drawn that electrolytic soln. tensions are functions of the affinities of the solutes for the solvent and of the internal forces acting in the solvent. The equation $k' = kP_B P_S / L_{BS}$ is proposed, according to which the electrolytic dissocn. const. k' in the liquid phase can be calcd. from the dissocn. const. k in the gas phase, the electrolytic distribution ratios P_B and P_S of the elements and the distribution ratio of the undissocd. compd. Explanations are given for the practically complete dissocn. of neutral salts, for the small change of electrolytic dissocn. with temp. and for deviations from the diln. law.

E. R. SMITH

The transference numbers and the degree of solvation of the ions of lithium chloride in certain alcohols. J. N. PEARCE AND W. G. EVERSOLE. *Proc. Iowa Acad. Sci.* 33, 151-64(1926).—The true and ordinary transference nos. of the Li ion in solns. of LiCl in Me, Et and *n*-Pr alcs. have been detd. Camphor was used as the reference substance. When these solns. are electrolyzed there is an increase in the concn. of the camphor at the anode and a decrease at the cathode. This change in the concn. of the camphor is produced by the migration of the solvent with the Li ion from the anode to the cathode. In a given solvent the values for the transference nos. and the degree of solvation of the Li ion decrease as the concn. of the LiCl is increased. For a fixed concn. of LiCl the observed values of the degree of solvation of the Li ion decrease as the complexity of the solvent mol. increases.

W. G. GAESSLER

Conductivity of organic compounds and certain elements in the solid and liquid state. M. A. RABINOVICH. *J. Russ. Phys.-Chem. Soc.* 58, 229-39(1926).—The cond. of org. compds. and halogens was investigated under a const. e. m. f. of 125 v. to det. the coeff. of loosening (α) of the crystal lattice, i. e., the ratio of the conductivities of the solid and liquid at the m. p., with the view of elucidating the mechanism of elec. dissocn. The individual conductivities of the halogen-substituted acetic acids and the nitroparaffins are not in the same order as their conductivities in aq. soln. The results show that symmetrical mols. with small dipole moments have little tendency to dissociate. This is confirmed by the values of α for the chloromethanes. The values of α for benzene, naphthalene, anthracene and substituted hydrocarbons are in the order of their polarity. The behavior of such substances in a non-polar solvent, such as ether, is analogous to the behavior in it of acids (palmitic, stearic) of the same individual solid and liquid cond. Finally, the halogens were investigated by themselves and in soln., and a dynamic theory of the internal ionization of the halogen mol. is discussed.

B. C. A.

Electrical resistance of concentrated sulfuric acid and theory of hydration. M. H. FISCHER AND M. O. HOOKER. *Kolloid-Z.* 40, 303-7(1926).—The elec. resistance of H_2SO_4 -water mixts. decreases with rise of temp. For a given temp. the resistance decreases with increasing concn. of H_2SO_4 , there being a min. when the mixt. contains 50 cc. of concd. H_2SO_4 (d. 1.84) and 200 cc. of water. Above this concn., the resistance increases rapidly, a second inflection indicating the presence of excess of SO_3 . The mode of variation of properties with compn. indicates a change from a soln. of H_2SO_4 in water to a soln. of water in H_2SO_4 , and the analogy with solvated colloids is discussed.

B. C. A.

On the diffusion of electrolytes. M. M. DUBININ. *J. Russ. Phys.-Chem. Soc.* 58, 623-9(1926).—The app. consisted of a cylindrical glass tube sealed at one end and provided with pairs of Pt electrodes at various distances from the bottom end closed by a glass plate. This tube was contained within a larger vessel through which passed the elec. connections, a rod on which the glass plate rotated and a rubber tube. The diffusometer, supported from a wall, was completely immersed in a thermostat regulated to within 0.1° . The inner vessel was filled with cond. water, the outer with the soln., and cond. measurements were taken at 12-hr. intervals. The concn. of the diffusing soln. changed by not more than 0.2% during the expt. The diffusion coeff. of 0.1-0.5 *N* KCl at 25° was $1.594 \pm .009 \text{ cm}^2 \text{ t./g.}$ calcd. from $dg = -D_0(1 + \beta c)(\partial c/\partial x)sd t$. With 0.1-1 *N* CaCl_2 , Wiedeburg's (*Ann. Phys.* 45, 675(1890)) relationship was found to hold; values of D_0 agreed within 1.5%, while D from Fick's equation varied by up to 10%. Fick's law represents the limiting case of a very dil. soln.

B. C. S.

Conductivity and molecular weight of halogen acids in dry and moist nitrobenzene. M. HLASKO AND E. MICHALSKI. *Rocz. Chem.* 6, 534-55(1926).—The conductivities of HCl and HBr in dry nitrobenzene and nitromethane are, in spite of the high dielec. consts. of the solvents, very small. Thus for dry nitrobenzene, α is 4.0×10^{-4} for

0.6 N HCl and 6.7×10^{-4} for 0.6 N HBr, while in nitromethane α is 9.4×10^{-4} for 8.7 N HCl. The presence of 0.1% of moisture increases the cond. tenfold. HBr is in all cases more dissociated than the chloride. Cryoscopic measurements show that H₂O, HBr and HCl, dissolved in nitrobenzene or in formic acid, are present as simple mols., but that the addn of HBr or HCl to wet nitrobenzene produces little depression of f. p., because of the formation of hydrates of the type HCl.H₂O, provided that it is added in quantities not greater than the water content. It follows that conclusions relative to the association of dissolved substances in the above solvents are not valid unless precautions are taken to eliminate water, and for this reason the results of Zanninovich-Tessarini (*Z. physik. Chem.* 19, 251-60(1896)) and of Beckmann and Lockemann (*C. A.* 2, 77), which indicated polymerization of hydrogen halides in the above solvents, are not acceptable. B. C. A.

Dilution law for strong electrolytes. B. SZYSZKOWSKI. *Rocz. Chem.* 6, 510-34 (1926).—The equiv. conds of strong electrolytes (univalent anion and cation) satisfy the following law from 0.0001 to 0.1 M solutions $1 - (\lambda/\lambda_0) = 0.5\beta C^{1/2} - \gamma C + 1.5\delta C^{3/2}$, where β , γ and δ are consts. This expression agrees fairly well with Kohlrausch's exptl. values and affords a confirmation of Debye and Hückel's theory for solns. of completely dissociated electrolytes. B. C. A.

Some anomalies in the theory of solution of strong electrolytes and their explanation. NIELS BJERRUM. *Trans. Faraday Soc.* 23, 445-54(1927).—(1) The heat of diln. of electrolytes varies with the size, a , of the ions in a direction opposite to that predicted by the equation, $U_r = 418\sqrt{C}/(1 + 0.327 a\sqrt{C})$, where U_r is the heat developed on adding a large amt. of water to a C molar soln. contg. 1 mol. of electrolyte. (2) The effect of the elec. charge on the partition coeff. of ions between water and alc. is always greater than is to be expected from the formula $P = 3.15/r$, where $P = \log_{10}$ of the partition coeff. and r is the radius of a spherical ion. (3) Many electrolytes show a remarkably small Soret effect. (4) A contraction occurs on soln. of a salt in water. (5) Some ions have a negative heat capacity in aq. soln. These anomalies are explicable by the assumption that the effective dielec. const. decreases in the immediate neighborhood of ions. E. R. SMITH

Strong electrolytes in relation to statistical theory, in particular the phase integral of Gibbs. R. H. FOWLER. *Trans. Faraday Soc.* 23, 431-43(1927).—The theory of Debye and Hückel is developed from the fundamental principles of statistical mechanics, by the method of Gibbs. The equations of Poisson and Boltzmann can be legitimately used together provided a certain fluctuation term can be ignored as small. This is legitimate for dil. solns. but it remains doubtful whether the more elaborate formulas can be quant. correct. The introduction of the dielec. const. makes use of a process of averaging in steps which is illegitimate though probably not seriously in error. It is shown directly from statistical theory that the thermodynamic function determinable from the analysis of Debye and Hückel is the characteristic function for this function by Debye and Hückel is correct and other thermodynamic properties must be deduced from it by the standard processes of thermodynamics. E. R. SMITH

Electrolytic transference of water, true transference numbers, ionic mobilities and water sheaths of the ions. H. REMY. *Trans. Faraday Soc.* 23, 381-8(1927).—The available data upon the electrolytic transference of water in 1 N aq. solns. of inorg. electrolytes are tabulated and used for the calcn. of the true transference nos. The mobility of an ion in a soln. is defined as the product of its true transference no. and the cond. of the soln. The product of true mobility and viscosity changes much less than that of apparent mobility and viscosity on passing from one soln. to another of homologous type. Abs. values for the water sheaths of ions are obtained from water transference in solns. of org. electrolytes with large cations not carrying water envelopes. E. R. SMITH

The activity of electrolytes. J. N. BRONSTED. *Trans. Faraday Soc.* 23, 416-34 (1927).—A review with references. E. R. SMITH

The influence of neutral salts on acid-salt equilibria. I. A contribution to the knowledge of the standard value used for calculating the activity exponent p_{aH} of the hydrogen-ion concentration. I. M. KOLTHOFF and WOUTER BOSCH. *Rec. trav. chim.* 46, 430-8(1927).—The calcn. of the H-ion concn., p_{H} , from potentiometric measurements is generally based on the standard value proposed by Sørensen. It is generally recognized that in the light of the Debye and Hückel theory, the calcn. of Sørensen's standard value is no longer correct. Since the potential of an electrode is a function of the activity of the H ions in the soln., it is of greatest importance that the activity

of the H ions in the standard H-electrode* acid mixt. (0.01 *N* HCl + 0.09 *N* KCl) be known. A standard value can then be obtained with which the activity exponent, p_{H} , in all kinds of solns. can be calcd. from the results of H-electrode measurements. Based on the data of G. Scatchard (cf. *C. A.* 19, 1366, 1520, 2156) for pure HCl, and on potential measurements using a quinhydrone electrode in the standard acid mixt. against a H electrode in the standard acid mixt. and in 0.001 *N* HCl + 0.099 *N* KCl, the suggestion is made that a value of 2.075 be accepted for the p_{H} in the standard acid mixt. If the p_{H} is calcd. on the basis of the classical formula of Sorensen, the following relation is obtained: $p_{\text{H}} = p_{\text{H}}^0 + 0.037$. Neutral salts first decrease the activity of the H ions in dil. HCl solns., and then tend to increase it at higher concns. A pronounced sp. cation effect of neutral salt influence was observed. R. L. D.

The activation of chemical reactions by neutral salts. I. The activation of the solution of marble by neutral salts. N. IZGARUISHEV AND FR. S. SCHAPIRO. *Z. physik. Chem.* 128, 230–8 (1927).—The authors have studied the effect of *N* solns. of MnCl₂, CoCl₂, (AcOH), KCl, SrCl₂, CaCl₂, NaCl, NiCl₂, BaCl₂, MgCl₂, AlCl₃, and NH₄Cl on the soly. of marble tablets (0.5 cc.-lg.) in 0.1 *N* AcOH and found that in general the velocity const. increases in the order in which they are given (*k* 108–276) and a general correspondence exists between the velocity and the p_{H} . MnCl₂ and NiCl₂ are irregular, and cases of similar p_{H} like NiCl₂ and CoCl₂, SrCl₂, and CaCl₂ give markedly different constns. Ionic vols. and velocity constns. show no simple relationship. The anion is almost without effect, as is shown by the similarity of constns. obtained with *M* solns. of KCl, KI (162) KBr, KClO₃, KBrO₃, KIO₃, KNO₃ (106–110) and 0.1 *N* AcOH. With 0.1 *N* HNO₃ the order is MnCl₂, ZnCl₂, CoCl₂, NiCl₂, (HNO₃) SrCl₂, LiCl, NH₄Cl, MgCl₂, KCl, CuCl, CuCl₂, BaCl₂, AlCl₃, NaCl (*k* = 215–976). The constns. were calcd. from the formula $k = (2.303/TF) \log (c/c - x)$, where *F* = surface. E. R. S.

Kinetics of dissolution of aluminum in acids and alkalis. K. JABLONCZYNSKI AND E. HERMANOWICZ. *Rocz. Chem.* 6, 466–82 (1926).—The velocity of dissoln. of Al in 0.1 *N* HCl or NaOH is independent of the rate of stirring, and increases by 126 and 137%, resp. per 10° rise in temp., showing that this is a purely chem. reaction. The velocity is proportional to the concn. of the acid, whence it follows that this is a unimolecular reaction. The metal may be rendered passive by immersion in oxidizing solns., the effect being greatest with H₂O₂, less with KMnO₄, and least with Br water. It may then be activated by contact with a Pt wire, but more vigorously by the addn. of HgCl₂, which so accelerates the rate of dissoln. that the process becomes one of diffusion, in this case, the temp. coeff. is small and the velocity depends on the rate of stirring. The velocity of dissoln. in 0.1 *N* NaOH is 18.5 times as great as that in acid. B. C. A.

The significance of the law for the speed of formation of hydrogen bromide from its elements. ANTON SKRAHAL. *Ann. Physik* 82, 138–42 (1927).—Herzfeld's derivation (*C. A.* 15, 1440) of the kinetic equation for the reaction $\text{H}_2 + \text{Br}_2 = 2\text{HBr}$ is claimed to be imperfect. S. proposes a new derivation based on the assumption that the concn. of monatomic Br is proportional to the sq. root of the Br₂ concn. F. R. B.

The influence of hydrogen on two homogeneous reactions. C. N. HINSHELWOOD AND P. J. ASKEY. *Proc. Roy. Soc. (London)* A116, 163–70 (1927).—The quasi-unimol. decompn. of CH₃CH₂CHO, which becomes bimol. at low pressures, in the presence of H retains its unimol. character for low pressures. This decompn. is analogous to that of Et₂O and of Me₂O (*C. A.* 21, 1581). The bimol. decompn. of CH₃CHO is only slightly influenced by the pres. of H, and not in such a manner as to make the reaction appear unimol. These expts. are consistent with the Lindemann theory (*Trans. Faraday Soc.* 17, 598 (1922)) that in the case of simple mols. like CH₃CHO there is no time lag between activation and transformation, while in the decompn. of a more complex mol., as CH₃CH₂CHO, such a time lag exists. R. J. HAVIGHURST

Oxidation of mixtures of stannous chloride and sodium sulfite in alkaline solution with air. SUSUMU MIYAMOTO. *Bull. Chem. Soc. Japan* 2, 191–6 (1927).—The velocity of oxidation of mixts. of SnCl₂ and Na₂SO₃ in 0.525, 0.752 and 1.092 *N* NaOH was found to be a little less than that of either alone (previously shown to be identical (*C. A.* 21, 2089, 3:99)), except when the concn. of SnCl₂ is low. Then the velocity is much smaller at first but increases with time. A. W. FRANCIS

The thermal decomposition of hydrogen peroxide. F. O. RICE AND O. M. REIFF. *J. Phys. Chem.* 31, 1352–6 (1927).—When H₂O₂ decomposes in the presence of inhibitors, dust, etc., there is an initial period of inhibition followed by decompn. at a rate similar to that of a unimol. reaction. When dust only is present the rate is that of a unimol. reaction. When the inter. of the reaction flask is freshly fused and all impurities including dust are removed (cf. *C. A.* 20, 3374), the decompn. is a zero-order decompn., and the rate is exceedingly slow. The ordinary decompn. of H₂O₂ occurs on the walls

of the vessel and on dust particles. The decompn. of H_2O_2 by the I-HIO_3 couples seems to occur on dust particles and the walls of the reaction vessel. F. E. BROWN

The unimolecular decomposition of azomethane; the adequacy of activation by collision. BERNARD LEWIS. *Proc. Nat. Acad. Sci.* 13, 546-9 (1927).—With a conservative estimate of the no. of effective internal degrees of freedom in the azomethane mol. $\text{CH}_3\text{N}:\text{NCH}_3$, it is shown that according to the equations of Fowler and Rideal (C. A. 21, 1047) collisions may account for the activation of 1.07×10^{20} mols. per cc. per second. The rate of decompn. exptly. detd. by Ramsperger (C. A. 21, 1742) was 1.67×10^{15} mols. per cc. per sec., so that collisions are adequate to account for the activation in this unimol. decompn. F. A. JENKINS

The rate of transformation of acetylchloroaminobenzene into *o*- and *p*-chloroanilides as a measure of the catalytic power of hydrochloric acid. F. G. SOPER. *J. Phys. Chem.* 31, 1192-6 (1927).—The catalytic activity of HCl given by the rate of formation of Cl is not proportional to the velocity coeff. of the transformation of acetylchloroaminobenzene into *o*- and *p*-chloroanilides as ordinarily measured. Such measurements contain a varying error which is, e. g., 0.915 of the true value in 0.2 *M* HCl and 0.970 of the true value in 0.8 *M* HCl. Deductions based on such measurements lead to a relative catalytic activity of the 0.8 *M* HCl which is about 6% too high in comparison with that of the 0.2 *M* HCl. The observed speed of transformation is found to be in satisfactory agreement with that calcd. on the assumption that the interaction of chloroamine and HCl is the slow stage, whereas no agreement is found with the value calcd. on the alternative assumption that the interaction between acetanilide and Cl is the slower. J. H. PERRY

The coefficient of saponification of ethyl acetate by sodium hydroxide. ETHEL M. TERRY AND JULIUS STIEGLITZ. *J. Am. Chem. Soc.* 49, 2216-22 (1927).—The reaction coeff. is detd. for 1/100 *M* mixts., in an improved Reicher app. Care is taken to exclude CO_2 at all times. The coeff. is calcd. from exptl. data, with the aid of the integrated form of the bi-mol. reaction equation, and is 6.75 at 25.00°, accurate to 0.75%. For each temp. rise of 0.01° the coeff. is increased 0.0045. J. BALOZIAN

The saponification of ethyl acetate. W. T. GOOCH. *J. Am. Chem. Soc.* 49, 2257 (1927).—It is established that variations of intensity of diffuse daylight such as may occur under varying lab. conditions have no effect on the rate of sapon. of Et acetate. With consns. of ester and NaOH of 0.008 and 0.01, resp., the av. coeff. in darkness and that in diffuse daylight was 6.77 at 25°.

Studies on the monoalkyl carbonates. IV. Solutions of carbon dioxide in anhydrous methyl and ethyl alcohol and monomethyl and monoethyl carbonate in anhydrous alcoholic solution and in the solid state. CARL FAURHOLT. *Z. physik. Chem.* 126, 227-37 (1927); cf. C. A. 21, 2413.—The apparent ionization consts. of monomethyl

and monoethyl carbonates, $K_{\text{HCH}_3\text{CO}_3 + \text{CO}_2} = \frac{a_{\text{H}^+} \cdot a_{\text{HCH}_3\text{CO}_3^-}}{a_{\text{HCH}_3\text{CO}_3} + a_{\text{CO}_2}}$ and $K_{\text{HC}_2\text{H}_5\text{CO}_3 + \text{CO}_2} = \frac{a_{\text{H}^+} \cdot a_{\text{C}_2\text{H}_5\text{CO}_3^-}}{a_{\text{HC}_2\text{H}_5\text{CO}_3} + a_{\text{CO}_2}}$, are calcd. from the ionization consts. of the 2 alcs., and the

equil. consts. for the reactions $\text{CH}_3\text{CO}_3^- = \text{CH}_3\text{O}^- + \text{CO}_2$ and $\text{C}_2\text{H}_5\text{CO}_3^- = \text{C}_2\text{H}_5\text{O}^- + \text{CO}_2$, to be $10^{-10.7}$ and $10^{-12.3}$, resp., at 18°. The equil. consts. were detd. by electro-metric measurements of the Me-ion concn. in a MeOH soln. of Na monomethyl carbonate of known concn. and known CO_2 concn., similar measurements being made for the monoethyl carbonate. The assumption that the true ionization const. of monomethyl carbonic acid in MeOH is 10^{-6} times that in H_2O gives $K_{\text{HCH}_3\text{CO}_3} =$

$a_{\text{H}^+} \cdot a_{\text{HCH}_3\text{CO}_3^-} = 10^{-8.7}$ and hence $\frac{a_{\text{HCH}_3\text{CO}_3}}{a_{\text{CO}_2}} = 10^{-2}$. The kinetics of the reactions are still undetd.; the reactions are fast, however. Expts. on the vapor pressure of CO_2 above solid Na monomethyl carbonate show the CO_2 to be firmly bound, no gas evolution taking place up to about 200°, when not CO_2 but ethylene is weakly evolved. The Na monomethyl carbonate was prepd. by saturating an anhydrous methyl alc. soln. of Na methylate. Na and K monoethyl carbonates were similarly produced.

R. L. HERSHEY

The kinetics of the intramolecular transformation of ammonium thiocyanate to thiourea and thiourea to ammonium thiocyanate. A. N. KAPPANNA. *Quart. J. Indian Chem. Soc.* 4, 217-28 (1927).—The NH_4CNS and $\text{CS}(\text{NH}_2)_2$ were recrystd. from EtOH and carefully dried. The $\text{CS}(\text{NH}_2)_2$ melted at 179°. Observations were made at 10° intervals from 140° to 180°. Two series of expts. were made. In the first series equal quantities of $\text{CS}(\text{NH}_2)_2$ and NH_4CNS were sealed in each of a dozen bulbs. The bulbs were immersed in a thermostat. At intervals a bulb was removed, cooled quickly

and the contents were analyzed. In the second series, tubes were used and samples were pipetted out at intervals. The results of the 2 series were concordant. Thiourea was std. iodometrically, as recommended by Reynolds and Werner (*J. Chem. Soc.* **83**, 1(1903)) and Werner (*C. A.* **7**, 946); and $\text{NH}_4\text{CNS} + \text{CS}(\text{NH}_2)_2$ by $\text{Hg}(\text{NO}_3)_2$ in dil. HNO_3 with ferric nitrate as an indicator (Williams Lunge's Technical Methods of Chem. Analysis, p. 656). The % $\text{CS}(\text{NH}_2)_2$ at equil. and heat of reaction, resp., for each temp. are: 140° , 28.10%, 3271 cal.; 150° , 26.24%, 3235 cal.; 160° , 24.56%, 3117 cal.; 170° , 23.09%, 3074 cal.; 180° , 21.76%. dx/dt for the direct reaction = $k_1 + k_2(\epsilon - x)$, where ϵ is the equil. value of x . $dx/dt = k_1 + k_2(a - \epsilon - x)$ is the equation for the reverse reaction. Integrating, one gets the same integration const. for both reactions. This is Waddell's test for a reversible reaction of the first order. (*J. Phys. Chem.* **2**, 538(1898)). The data taken when glass wool and Pt strips were put into the heated mixt. differed but little from those taken when the mixts. were not so treated. The mean heat of activation of NH_4CNS over the range 140 – 180° is 31,935 cal.; for $\text{CS}(\text{NH}_2)_2$ over the same range is 35,016. The heat of reaction, 3174 cal., is almost equal to the difference between these heats of activation, 3081 cal. The Dushman-Rideal equation gives values in good agreement with that observed for the velocity const. of the reaction $\text{CS}(\text{NH}_2)_2 \longrightarrow \text{NH}_4\text{CNS}$ but not for the reverse reaction. The active lives of the mol. have been calcd. to be 7.24×10^{-12} sec. for NH_4CNS and 8×10^{-14} sec. for $\text{SC}(\text{NH}_2)_2$. F. E. BROWN

The reaction of chlorine, hydrogen and oxygen when insulated. E. CREMER. *Z. physik. Chem.* **128**, 285–317(1927).—C. has studied the reaction of mixts. of dry Cl from cylinders (27.5–258-mm. pressure), O (18.7–166.4 mm.) and H (67–342 mm.) prep'd. by electrolysis of KOH soln. over P_2O_5 in Thuringia glass vessels at 12.5° when insulated by a 1000 c. p. lamp at a distance of 20 cm. The short wave lengths were removed by a screen of lead glass. The residual gases were analyzed by absorption in 10% KI soln. followed by titration of the liberated I with $\text{Na}_2\text{S}_2\text{O}_3$ and the H ion with barite after removal of CO_2 by heat. The velocity of formation of HCl is expressed by $d[\text{HCl}]/dt = kc[\text{Cl}_2]^2[\text{H}_2]/([\text{Cl}_2] + k'[\text{H}_2][\text{O}_2])$, that of H_2O by $d[2\text{H}_2\text{O}]/dt = k_w[\text{Cl}_2]$. A chain of 18 components is theoretically possible and is indicated by expt. The lack of agreement among previous workers is attributed to the catalytic effect of the walls and on the varying proportions of O which at low pressures permits one of the intermediate reactions to go to completion. Values for 41 expts. and drawing and description of the app. are given. F. R. S

The thermal dissociation of the alkali fluoborates. J. H. DE BOER AND J. A. M. VAN LIEMPT. *Rec. trav. chim.* **46**, 124–32(1927).—The fluoborates of K, Rb, Cs have been prep'd. by pptn. from H_2O by addn. of the chlorides to solns. of HBF_4 . The prep'n. is described in detail. The solubilities in H_2O are in the order Li, Na, K, Rb, Cs. Thermal studies show the m. ps. to be: KBF_4 , 530° ; RbBF_4 , 590° ; CsBF_4 , 550° . Though the alkali fluorides take up BF_3 readily to give the fluoborates, CaF_2 does not. Calcn. of thermal data shows the heat of reaction for this case would be neg. The η s of these salts are very near those of the sat'd. solns. These indices have been det'd. for the Na D line. R. L. HERSHEY

Reactions in solid crystallized organic substances on heating. BERNWARD GARRE. *Z. anorg. allgem. Chem.* **164**, 81–5(1927).—Unstable org. substances, when heated below the m. p., are capable of being transformed into stable forms with the evolution of heat. A mixt. of org. substances whose interaction liberates heat can react to form the stable substance upon being heated below the eutectic point. These rules are illustrated by the conversion of NH_4 cyanate to urea, maleic to fumaric acid, and the interaction of the following mixts.: hydroquinone-*m*-phenylenediamine, pyrocatechol-*o*-phenylenediamine, hydroquinone-*p*-phenylenediamine, and resorcinol-*p*-phenylenediamine. DAVID DAVIDSON

The action of oxalic acid on some soluble salts of lead. N. DEMASSIEUX. *Compt. rend.* **185**, 460–1(1927).—When $\text{H}_2\text{C}_2\text{O}_4$ reacts with PbCl_2 in soln. a white ppt. of $(\text{Pb}_2\text{C}_2\text{O}_4)\text{Cl}_2$ (I) is obtained which, by further addn. of the acid, is converted into PbC_2O_4 (II). The reactions were studied by means of cond. measurements and plotting the cond. values against the amts. of acid used. Each curve shows 2 points where an abrupt change in direction occurs, the first corresponding to the formation of (I) and the second to that of (II). Analogous results are obtained with PbBr_2 when $(\text{Pb}_2\text{C}_2\text{O}_4)\text{Br}_2$ is formed. With PbI_2 only one break in the curve is observed. E. O. ELLINGSON

The mutual replacement of sodium and potassium in their chlorides. L. HACKSPILL AND E. RINCK. *Compt. rend.* **185**, 463–5(1927).—The equil. const. of the system Na-KCl or K-NaCl in which variable amts. of the components are placed in direct contact without any solvent has been det'd. at 900° . The av. value from a large

no. of expts. is 11, expressed as $[KCl][Na]/[NaCl][K] = 11$. The materials are kept in a sealed iron tube which is heated electrically and shaken vigorously in a horizontal position by a mech. shaking device. Although equil. is attained in a short time the mixt. is heated and shaken for $1/2$ hr. after which the tube is placed in a vertical position for another $1/2$ hr. to assure sepn. of the 2 phases before solidification. No precise detn. was made to find the equil. const. at a lower temp. than 900° but 2 expts. at 800° gave values of 14 and 16 which shows that the const. increases when the temp. is lowered. Reference is made to the work of Jellinek and Tomoff in *C. A.* 19, (1084), who give 12.2 as the av. value at 860° , but in their case one of the phases consisted of an alloy of Pb, K and Na and the other the chlorides of the metals.

E. O. E.

The ternary system sodium chloride-platinum chloride-water at 25° . T. A. GENKE. *J. Russ. Phys.-Chem. Soc.* 58, 596-600 (1926).—The soly. isotherm at 25° is composed of 3 branches corresponding to NaCl, Na_2PtCl_6 and $PtCl_4$, resp.; as the sep. phases. The soly. curve of Na_2PtCl_6 is continuous, showing this compd. to be at the same time a complex of NaCl and $PtCl_4$, and a Na salt of H_2PtCl_4 . (Where NaCl was present in soln. the system reached equil. in 6-8 hrs.; in the presence of $PtCl_4$, on the other hand, over a day was required for complete equil., and individual measurements deviated to either side of the curve. The d. isotherm shows an analogous behavior, which is explained by the greater viscosity of soln. contg. $PtCl_4$ retarding the crystn. of Na_2PtCl_6 .)

BASIL C. SOVENKOFF

The ternary system formic acid-sodium formate-water. E. ELÖD AND K. TREMMEL. *Z. anorg. allgem. Chem.* 165, 161-70 (1927).—The soly. isotherms for the system $HCOOH-HCOONa-H_2O$ were detd. at 13.0° , 23.4° and 45.0° . The identity of the solid phase was detd. by means of a polarization microscope. The soln. was analyzed for total formate by oxidation, and for free formic acid by titration. Gravimetric analysis of the solid phase was carried out. The results are shown by the accompanying triangular coordinate diagram.

R. L. DODGE

Some observations on the system phenol-water. F. R. JONES. *J. Phys. Chem.* 31, 1316-21 (1927).—The expts. were carried out between -2° and 13° . The hydrate $(C_6H_5OH)_2 \cdot H_2O$ formed spontaneously above -1° , and by seeding, large amts. were easily prepd. The concns. of phenol were detd. by the method of Redman, Weith and Brock (cf. *C. A.* 8, 1554). When g. of phenol per 100 g. of soln. is plotted against temp., there are 2 eutectic points. At -0.843° , 4.607 g. of phenol per 100 g. of soln. is in equil. with $(C_6H_5OH)_2 \cdot H_2O$ and ice. At -1.174° , ice and $(C_6H_5OH)_2$ are in equil. with phenol soln. contg. 6.839 g. per 100 g. soln. There are 5 invariant points and a doubly unstable region. The m. p. of pure C_6H_5OH is 40.71° ; of C_6H_5OH under H_2O is 1.80° ; of $(C_6H_5OH)_2 \cdot H_2O$ under H_2O is 12.17° .

F. E. BROWN

The new singular elements: an isothermal plane and a singular solid angle. V. I. NIKOLAEV. *Ann. inst. anal. phys. chim.* 3, 473-4; *J. Russ. Phys.-Chem. Soc.* 58, 553 (1926).—Soly. isotherms of $Na_2O-N_2O_5-H_2O$ at 25° in presence of 5, 15 and 30% of EtOH were detd. The singular points of intersection form a singular curve (using a triangular prism to represent the system) which represents the change of soly. of $NaNO_3$ in function of the concn. of EtOH. A singular plane passing through the bisecting lines $H_2O-NaNO_3$ divides the prism into an alk and an acid half. With increasing concn., the angle of intersection of the isotherms approaches 180° .

B. C. S.

Cryohydric lines of the ternary system Na-O-Na₂O₂-H₂O. V. I. NIKOLAEV. *J. Russ. Phys.-Chem. Soc.* 58, 557-64 (1926).—The lowering of the eutectic temp. of $NaNO_3$ by HNO_3 and NaOH obeys Raoult's law until about 4% by wt. Two triple eutectics were found: $-46.4^\circ (NaNO_3 + H_2O + HNO_3 + 3H_2O)$ and $-39.1^\circ (NaNO_3 + H_2O + NaOH \cdot 7H_2O)$. The binary eutectic $H_2O-NaNO_3$ lies at -18.1° .

B. C. S.

The system ferric oxide-arsenic acid-water at low concentrations of arsenic acid. N. H. HARTHORNE. *J. Chem. Soc.* 1927, 1759-68.—Using an app. previously described (cf. *C. A.* 19, 193), H. has studied the system $Fe_2O_3-As_2O_5-H_2O$ at 25° at the concns. 2.6 23.3% As_2O_5 and found 2 solid phases: the neutral salt $Fe_2O_3 \cdot As_2O_5 \cdot xH_2O$ (x probably near 6), amorphous, which adsorbs H_2AsO_4 and the new acid salt $Fe_2O_3 \cdot 2As_2O_5 \cdot 8H_2O$, which is isomorphous with $Fe_2O_3 \cdot 2P_2O_5 \cdot 8H_2O$. The system attained equil. very sluggishly. The phase samples were analyzed for As by converting this element into $AsCl_3$ by the method of Jannasch and Seidel and then titrating with KIO_3 ; for Fe by $K_2Cr_2O_7$ after reduction with $SnCl_2$. In the liquid phase Fe was detd. colorimetrically with NH_4CNS .

E. R. SCHIERZ

The system magnesium-cadmium. WM. HUME-ROTHERY AND S. W. ROWELL. *J. Inst. Metals* 445 (advance copy), 18 pp. (1927).—Thermal and microscopic methods were used to study the equil. relations of Mg-Cd. Two solid solns. and the compd.

MgCd₂ occur. No evidence of the compd. MgCd was found. The transformation of the β -solid soln. takes place at 54 at. % Mg and not at 50% as previously reported. No alteration in microstructure accompanied the change. Prolonged annealing is required to attain equil. in the solid alloys when MgCd₂ is about to form. The β -solid soln. extends from 40 to 100% Mg. Equil. diagrams and tables accompany the paper.

J. W. SHIPLEY

Study of the systems uranyl sulfate-alkali sulfate-water at 25°. A. COLANI. *Compt. rend.* 185, 273-5(1927); cf. C. A. 10, 2672; 11, 2864; 19, 3183; 21, 27.—The soly. curve of the system $\text{UO}_2\text{SO}_4\text{-(NH}_4)_2\text{SO}_4\text{-H}_2\text{O}$ shows the existence of the following solid phases: $\text{UO}_2\text{SO}_4\cdot 3\text{H}_2\text{O}$, $(\text{NH}_4)_2(\text{UO}_2)_2(\text{SO}_4)_3\cdot 5\text{H}_2\text{O}$, $(\text{NH}_4)_2\text{UO}_2(\text{SO}_4)_2\cdot 2\text{H}_2\text{O}$ and $(\text{NH}_4)_2\text{SO}_4$. The existence of the compd. $(\text{NH}_4)_2(\text{UO}_2)_2(\text{SO}_4)_3\cdot 5\text{H}_2\text{O}$ had not been previously noted; but Morton and Bolton (*Chem. News* 28, 50(1873)) had shown the existence of the anhyd. compd., and Burger and Rimbach (*Inaug. Dissert.*, Bonn, p. 46(1904)) had prep'd. the corresponding hydroxylamine salt. The soly. curve of the system $\text{UO}_2\text{SO}_4\text{-K}_2\text{SO}_4\text{-H}_2\text{O}$ shows the existence of the following solid phases: $\text{UO}_2\text{SO}_4\cdot 3\text{H}_2\text{O}$, $\text{K}_2(\text{UO}_2)_2(\text{SO}_4)_3\cdot 5\text{H}_2\text{O}$ (new), $\text{K}_2\text{UO}_2(\text{SO}_4)_2\cdot 2\text{H}_2\text{O}$ and K_2SO_4 . The soly. curve of the system $\text{UO}_2\text{SO}_4\text{-Na}_2\text{SO}_4\text{-H}_2\text{O}$ shows the existence of the following solid phases: $\text{UO}_2\text{SO}_4\cdot 3\text{H}_2\text{O}$, $\text{Na UO}_2(\text{SO}_4)_2\cdot 3\text{H}_2\text{O}$, $\text{Na}_4\text{UO}_2(\text{SO}_4)_3\cdot 3\text{H}_2\text{O}$ (new), which is the only one of the salts of this series which exists in the cold (in presence of an excess of Na_2SO_4), and $\text{Na}_2\text{SO}_4\cdot 10\text{H}_2\text{O}$. The curves for the first 2 systems are given; those of the third system will be published later with details of the expts. The curves seem to indicate that at 25° the compds. obtained act as true double salts.

A. PAPINEAU-COUTURE

Electrometric study of the system potassium chloride-lead chloride water at 25°. A. J. ALLMAND AND L. J. BURRAGE. *Trans. Faraday Soc.* 23, 470-7(1927); cf. C. A. 20, 3402.—The activities of KCl and PbCl_2 in ternary solus. were measured by e. m. f. of Ag-AgCl (or Hg-HgCl) electrodes. The ternary diagram was embellished with *isodynamics*, or lines of equal activity of KCl or PbCl_2 , resp., viz., those with 0.01, 0.02, 0.05, 0.1, 0.2, 0.5, 0.75 the activity of the solid salts. The significance of these curves is discussed, and certain confirmation of data will be sought in v. p. measurements.

A. W. FRANCIS

Studies on lactic acid. IV. The distribution of lactic acid between water and ether and between water and amyl alcohol. R. DIETZEL AND E. ROSENBAUM. *Biochem. Z.* 185, 275-86(1927); cf. C. A. 21, 3008.—The distribution coeff. of lactic acid at 20° and in concn. of 1 mol./l. between water and ether is not const., and varies from 11.3 when $c_w = 0.931$ mol./l. to 8.7 at $c_w = 0.201$ mol./l. For amyl alc. the coeff. varies from 2.42 ($c_w = 0.756$ mol./l.) to 2.13 ($c_w = 0.242$ mol./l.) and under complete suppression of dissocn. of the acid from 2.37 to 2.15. Temp. has a very slight effect upon the distribution coeff. between H_2O and ether.

S. MORGULIS

The kinetics of homogeneous catalysis. Experimental investigation of the mechanism of a homogeneous catalytic reaction. EUGEN SHMITAL'SKII AND N. KOBASEV. *Z. physik. Chem.* 127, 129-77(1927); cf. C. A. 20, 3624.—The results obtained by S. in his study of the homogeneous catalytic decompn. of H_2O_2 by chromic acid and its salts, are used to test mathematically the validity of S.'s intermediate-compd. theory of catalysis. The reaction velocity measurements permitted the calcn. of the affinity const. for the hypothetical intermediate compd. of H_2O_2 and $\text{Cr}_2\text{O}_7^{2-}$. By the use of this const. it is possible to calc. the coordinates of the reaction-velocity curve. It is necessary to assume the existence of more than one intermediate compd. in order to account for all the observed results.

R. L. DODGE

The shifting of e-uilibrium by materials that exert a simultaneous favorable influence (catalyze) reactions. II. N. SCHLESINGER AND R. MALKINA-OKUN. *Ber.* 60B, 1479-83(1927); cf. C. A. 21, 1048.—The formation and sapon. of Et acetate in the presence of HCl, HBr and H_2SO_4 at 100° and HBr and HCl at 13° was studied. The catalyzers depress the equil. consts. in proportion to the concn. of the acid. HBr has the greatest effect at 100° and H_2SO_4 the least. The influence of HBr is less at lower temp. Extrapolation of the linear relations connecting acid concn. with equil. const. for the 3 acids at 100° gives the same value for the equil. const. without acid in each case.

F. L. BROWNE

Antioxygen catalysis. CHARLES MOUREU. *Chimie et industrie Special No.*, 101-9 (1927).—An address outlining the main points of M.'s work on this subject and the theory he has put forward to explain observed facts.

A. PAPINEAU-COUTURE

Catalytic hydrogenation and dehydrogenation by metal oxides. PAUL SABATIER AND ANTONIO FERNANDEZ. *Compt. rend.* 185, 241-4(1927); cf. S. C. A. 21, 3303.—The dehydrogenating action of oxides which are practically unreducible by H was verified on compds. other than primary alcs. Passing piperidine vapors through an

empty tube heated above 600° caused very little decompn. with very slight evolution of H; but when the vapors were passed under the same conditions through a tube contg. MnO there was a steady evolution of H and production of a brown liquid consisting of a mixt. of pyridine and dipyridyl (due to dehydrogenation of the pyridine), boiling below 250°. The same dehydrogenation is readily obtained with reduced Ni even at 250°. As previously noted (*loc. cit.*), dehydrogenating oxides should also act as hydrogenation catalyzers. PhNO₂ was entrained by an excess of H₂ through a pyrex tube contg. MnO, which was heated progressively; at about 350° there was slight formation of H₂O vapor and NH₃; at 450°, and especially at 600°, the reaction was quite rapid, with evolution of considerable NH₃ and small quantities of CO₂, with condensation of a liquid contg. NH₄OH, H₂O, PhNH₂, a little C₆H₆, and considerable proportions of Ph₂NH and Ph₃N. In the absence of catalyzer, the decompn. is negligible. ZnO gives practically the same results as MnO. Al₂O₃ (prepd. by pptn. and drying in the oven) gives but slightly more decompn. than when no catalyzer is used. For direct hydrogenation of nitrous ethers ZnO is more active than MnO. With isoamyl nitrite the reaction proceeded regularly, giving mainly di- and tri-isoamylamine; and similarly with isobutyl nitrite. Direct hydrogenation of capronitrile (C₆H₁₁CN) proceeded similarly at 500° with either MnO or ZnO, with evolution of large quantities of NH₃ and formation of a mixt. of the 3 corresponding hexylamines, the dihexylamine predominating. Hydrogenation over MnO gave unsatisfactory results with the ethylene hydrocarbons (with which reduced Cu frequently does not give good results) and with ketones (the rate of decompn. of the secondary alc. formed being much greater than the rate of formation at the active temp. of the catalyzer). A. PAPINEAU-COUTURE

The catalytic decomposition of formic acid. HANS TROPSCH. *Abhandl. Kenntnis Kohle* 7, 1-8(1925); *Chem. Zentr.* 1926, 1, 3298-9.—Water-free HCO₂H vapor was conducted over heated contact substances. At 355° the decompn. to CO₂ and H occurred most readily with Fe and tinned Fe, less readily with Cu and to the smallest extent with Al. Part of the HCO₂H was recovered in all cases. At 255° with tinned Fe, HCO₂H decompd. to CO and H and formed small quantities of CH₄. Glass wool, asbestos and pumice at 355° formed both CO and CO₂ and water, as did CaCO₃ at 400°, Li₂CO₃ at 255-410° and ThO₂ at 355° with simultaneous formation of yellow liquid reduction products (probably contg. MeOH). Al₂O₃ at 305° and 435° formed almost exclusively CO and H₂O, whether the HCO₂H was dry or contained water vapor. C. C. DAVIS

The catalytic decomposition of formaldehyde. HANS TROPSCH AND OTTO ROEHLER. *Abhandl. Kenntnis Kohle* 7, 15-36(1925); *Chem. Zentr.* 1926, 1, 3298.—HCHO vapor, obtained by vaporization of paraformaldehyde or of HCHO soln., was led at high temps. (in most cases 400°) over contact substances, including Na₂CO₃ (300-500°), CaCO₃, BaCO₃, ZnO, Al₂O₃, ThO₂, Cr₂O₃, UO₂, Fe, alk. Fe, Sb, Pb (195°), quartz (600°) and activated C. Decompn. was very rapid except with Sb and quartz. Considerable MeOH was formed with Na₂CO₃, Al₂O₃ (44% of the HCHO decompd.), ThO₂, UO₂ and activated C, in the first 2 cases with much deposition of C from water-free HCHO. Formation of CH₄ occurred especially with Cr₂O₃ (8% yield) and with activated C (9% yield), while the formation of unsatd. hydrocarbons occurred with Al₂O₃ (5% yield). A 5% yield of HCO₂H was obtained with UO₂. ZnO gave few reaction products of high mol. wt., and it decompd. dry HCHO smoothly to CO and H, and moist HCHO to CO₂ and H. In almost all cases the formation of an oil with an odor of a terpene character and in some cases fatty substances were observed. C. C. DAVIS

Comparative experiments on the decomposition of carbon monoxide by contact substances. HANS TROPSCH AND ALEX. VON PHILIPPOVICH. *Abhandl. Kenntnis Kohle* 7, 44-5(1925); *Chem. Zentr.* 1926, 1, 3298.—Purified and dried CO was conducted over contact substances at 400°. Its decompn. according to the reaction: 2CO → CO₂ + C, was measured by detg. the CO₂. Ni was the most active catalyst, but this activity was almost completely destroyed by alloying the Ni with 50% Sn. Great differences were found among different types of Fe. With a CO current of 400 cc. per hr., the following % CO₂ were found in the issuing gas: with Ni, 36.4; Fe from Fe₂O₃, 10.4, ferr. reduct., 2.3; ZnO, 0.9; MnO, 0.8; Cr₂O₃, 0.6; NiSn, 0.3-0.6; Al₂O₃, 0.4; BaSO₄, 0.4; tinned Fe, 0.4; MgO, 0.2; Cu 0.0. C. C. DAVIS

The decomposition of methanol by iron, tin and aluminum. HANS TROPSCH AND ALBERT SCHELLENBERG. *Abhandl. Kenntnis Kohle* 7, 13-4(1925); *Chem. Zentr.* 1926, 1, 3298.—MeOH vapor was conducted over the metal heated and spread out with a combustion tube. At 520° C was deposited on the Fe, decompn. of the MeOH to a gas contg. 4-7% CO₂, 20-25% CO, 55-60% H and 3-12% CH₄, occurring. The small quantity of condensate was neutral and contained HCHO. With tinned Fe,

the decompn. of MeOH followed the same course, but was only slight. With Al at 520°, the gas contained 5% CO₂, 2% CO, 60% H and 4% CH₄, and at 270° it contained 2% CO₂, 5% CO, 52% H and 30% CH₄. In a receiver cooled with liquid air there condensed a reaction product contg. Al, probably AlMe₃. C. C. DAVIS

The decomposition of methanol by metals and metallic oxides. A. SCHIELLENBERG. *Abhandl. Kenntnis Kohle* 7, 9–12 (1925); *Chem. Zentr.* 1926, I, 3298.—A compilation of the literature on the thermal decompn. of MeOH by various contact substances. C. C. DAVIS

The reduction of carbon monoxide to formaldehyde and methanol at ordinary pressure. ALBERT JAEGER. *Abhandl. Kenntnis Kohle* 7, 51–4 (1926); *Chem. Zentr.* 1926, I, 3393.—A survey of the literature. C. C. DAVIS

Nature of the sintering of active copper catalysts. F. H. CONSTABLE. *J. Chem. Soc.* 1927, 1578–84.—Sintering of an active Cu surface results in 2 effects, (1) reduction of the area of the exposed surface, and (2) collapse of some of the active centers on the surface. The course of oxidation of Cu was followed by measurements of the elec. cond. of the Cu-oxide mixt. and by estn. of the thickness of the surface film of oxide by means of its color in normally reflected light. From the initial values of the rate of oxidation of active and sintered catalysts the ratio of area of the surface in the 2 states was calcd. The surface area was reduced to about 1/3 while the catalytic activity was reduced to about 1/7; thus the reduction in the surface was somewhat more effective in reducing catalytic activity than was the collapse in the actual centers existing on the surface. The energy present in the centers of activity is not very greatly in excess of that possessed by the regular arrangement of the surface atoms. R. L. DODGE

"Active" iron. A. SIMON AND K. KÖTSCHAU. *Z. anorg. allgem. Chem.* 164, 101–26 (1927); cf. Baudisch and Welo, *C. A.* 20, 438.—Guaiac resin is a more sensitive reagent for ferric or ferrous ions (the latter in the presence of H₂O₂) than benzidine. In neutral soln., the reaction can detect Fe in a diln. of 0.0056 mg. per l. Extn. with CHCl₃ intensifies the reaction, which is not sp. for Fe but is given by Co, Mn, Cu, Hg, Ni and their salts, as well as by the oxidizing agents Cl, Br, I and KMnO₄. The positive reaction obtained with ferrum reductum which has been rubbed in a mortar is ascribed to ferrous ions resulting from the soln. of Fe as the bicarbonate. Filtrates obtained from aq. suspensions of ferrum reductum decompose H₂O₂, that derived from rubbed iron being slightly more active. The activity of these filtrates disappeared only slowly on standing and was accompanied by pptn. of the Fe. In an atm. of CO₂, preps. maintained their activity and were only slightly affected by ultra-violet light. DAVID DAVIDSON

Catalytic oxidation of ammonia and hydrogen cyanide. III. J. ZAWADSKI AND I. LICHTENSTEIN. *Rocz. Chem.* 6, 824–37 (1926).—The oxidation of NH₃ to NO with a Pt catalyst commences at 250°; that of HCN at about 400°. In this reaction, if the rate of flow of the reaction mixt. is small, a considerable quantity of free N is found among the products; at velocities of more than 60 l. per hr. for NH₃ and 23 l. per hr. for HCN, part of these gases passes unchanged at a temp. of 600°. The concn. of substrate in the reaction mixts. does not appear greatly to influence the reaction, the course of oxidation depending more on duration of contact and temp. The yield of NO at a given temp. at first increases to a max. and then decreases with increasing rate of flow, the optimal value for the latter increasing with temp. By selecting appropriate values for the above two factors, yields of up to 100% of NO may be obtained. B. C. A.

Catalytic decomposition of ammonia. GEORG-MARIA SCHWAB. *Z. physik. Chem.* 128, 161–81 (1927).—The rate of catalytic decompn. of NH₃ on glowing Pt and W filaments was measured by a static method. The app. was essentially the same as that previously described (cf. *C. A.* 20, 2933, 3632). The amt. of NH₃ remaining undecompd. in the reaction vessel at the end of various time intervals was directly detd. The rate of decompn. on Pt and W at low pressures can be expressed by the equation $-dc/dt = (k.c)/(\delta n + \epsilon h)$, where C is the NH₃ pressure, n in the N pressure, and h is the H pressure. The equation is explained on the basis of Langmuir's unimol. layer theory of surface catalysis. At higher pressures the measurements no longer support this theory. R. L. DODGE

The weakening of the oxidative power of ferric chloride by heating and its regeneration. M. J. GRAMENITZKI. *Biochem. Z.* 185, 430–2 (1927).—The blueing of tincture of guaiac or of KI-starch by active O₂ is catalyzed by FeCl₃. If, however, the FeCl₃ soln. is boiled and then cooled, the blueing reaction is greatly inhibited, but the

catalyzing effect is regenerated gradually if the FeCl_3 is left standing before using it in the reaction. This effect is ascribed to the lowering of disson. of FeCl_3 by heat.

S. MORGULIS

The catalytic activity of metallized silica gels. II. The hydrogenation of acetylene. V. N. MORRIS AND L. H. REYERSON. *J. Phys. Chem.* **31**, 1332-7(1927); cf. *C. A.* **18**, 3012.—Catalysts made by reducing finely divided Pt, Pd or Cu, deposited within the pores of silica gel were tested by a dynamic method for their activity in catalyzing the reduction of C_2H_2 to C_2H_4 with H. The app. used was similar to that already described by M. and R. Both C_2H_4 and C_2H_6 were produced. As the temp. was raised the catalysts became effective in the order: Pd 50°, Pt 100°, Cu 200°. As the ratio of C_2H_2 :H was increased from 1:10 to 3:1 the production of C_2H_4 went through a max.

R. L. DODGE

The mechanism of the catalytic decomposition of hydrogen peroxide solutions by metal ions. A. V. KISS AND F. L. EDERER. *Rec. trav. chim.* **46**, 453-62(1927).—The rates of decompn. of H_2O_2 soln. in the presence of Ca, Cd, Mg, Sr, Zn, Co, Cr, Mn, Ni, Cu and Fe ions were measured at 40°. Only the Cu and Fe ions showed any considerable catalytic effect. Cr ions exhibited a slight catalytic action. In the case of catalysis by Cu ions, the reaction mechanism may be indicated by the equations, $2\text{Cu}^{++} + \text{H}_2\text{O}_2 = 2\text{H}^+ + 2\text{Cu}^+ + \text{O}_2$; $\text{Cu}^+ + \text{H}_2\text{O}_2 = \text{Cu}^+\cdot\text{H}_2\text{O}_2$; $\text{Cu}^+\cdot\text{H}_2\text{O}_2 + \text{Cu}^+ = 2\text{OH}^- + 2\text{Cu}^{++}$; $\text{H}^+ + \text{OH}^- = \text{H}_2\text{O}$. It was shown exptl. that a definite equil. between Cu^{++} and Cu^+ ions was reached during the catalysis. The position of this equil. was dependent on the exptl. conditions. However, the limiting reaction in the case of catalysis by Fe ion is not an ionic reaction.

R. L. DODGE

The adsorption of hydrogen and ethylene on a copper catalyst poisoned with carbon monoxide. C. W. GRIFFIN. *J. Am. Chem. Soc.* **49**, 2136-45(1927).—Pease's (cf. *C. A.* **17**, 2220; **18**, 188; **19**, 1981) method of measuring adsorption of H and C_2H_4 on a Cu catalyst was again employed in measuring the adsorption of these gases on Cu catalysts that had been poisoned with adsorbed CO. The poison caused an increase in adsorption at low pressures and a decrease in adsorption at high pressures. The poison decreased the activity of the catalyst for the hydrogenation of C_2H_2 . The CO, in causing extra, low-pressure adsorption of H and C_2H_2 does not leave the H or C_2H_2 in an activated state. A general interpretation of the results is made by assuming the process of sorption to comprise a secondary factor such as soln. in addn. to surface adsorption.

R. L. DODGE

The significance of iso-catalytic data and the so-called proton theory of chemical reactivity. H. M. DAWSON. *J. Phys. Chem.* **31**, 1400-3(1927); cf. *C. A.* **21**, 2834.—Bergstein and Kilpatrick's discussion (cf. *C. A.* **21**, 521) of D and Powis' earlier results (cf. *C. A.* **7**, 334) is based on a misconception. The interpretation of observations on the autocatalytic reaction between acetone and I leads to conclusions very different from those drawn by Bergstein and Kilpatrick. The factors which det. the incidence of min. reaction velocity are considered mathematically in relation to the catalytic catenary, and it is shown that the proton theory of chem. reactivity is entirely inconsistent with established facts.

R. L. DODGE

Velocity of autocatalytic decomposition of bromosuccinic acid in aqueous solutions. J. ZAWISKI AND W. WYCZALKOWSKA. *Rocz. Chem.* **6**, 415-65(1926).—Various equations for the autocatalytic decompn. of bromosuccinic acid are derived. The addn. of HBr to the reaction mixt. changes the reaction velocity equation from $dx/dt = k_0(a - x)/x$ to $k_0(a - x)/(b + x)$, where b is the concn. of HBr and k_0 remains const. (0.000768). The addn. of equiv. quantities of Na_2SO_4 , which combines with the H ions produced in the reaction, changes the velocity equation to $k(a - x)/\sqrt{\rho x}$, where k is twice as great as k_0 , and ρ is the degree of disson. of the HSO_4 ion. The same equation holds for the velocity of decompn. of aq. acid bromosuccinates, substituting for ρ the degree of disson. of bromosuccinic acid. The normal Na and K salts are hydrolyzed according to the equation $dx/dt = k(a - x)^{1/2}/\sqrt{x}$. The retarding influence of HNO_3 is half as great as the t of equiv. quantities of HCl or HBr, the velocity in this case being $k_0(a - x)/(b/2 + x)$, where b is the concn. of HNO_3 . The addn. of KBr changes the velocity of reaction to $k_0(a - x)/(b/2n + x)$, where $n > 1$. Since, therefore, the velocity of reaction is retarded by both H and Br ions, the original equation should be expressed as $k_0(a - x)/2x$, whence it follows that the real value of k is 0.000154.

B. C. A.

Graphical method for the stem correction of glass thermometers. E. BERL AND A. KULLMANN. *Ber.* **60B**, 815 7(1927).—The prepn. of a nomogram giving stem correction of a glass thermometer is described.

F. R. B. CHOW KY

A new simple method for the production of very low temperatures. FRANZ SIMON.

Physik. Z. **27**, 790-2(1926).—As a rule very low temps. are produced by liquefaction and vaporization of gases (H and He). Since no continuous transition is feasible from the b. p. of N to that of H and from the b. p. of the latter to that of He, the Linde process must be applied, which is used advantageously for industrial purposes but causes great difficulties in the laboratory on account of the necessary tech. equipment and the operating personnel. S. describes a new method which permits closing the gap between the b. ps. of the gases utilizing the fact that the heat of adsorption of the gas on adsorbent C is frequently higher than the heat of vaporization. Thus to liquefy He the following process is used: A vessel with adsorbent C is placed in a Dewar vessel with liquid H the pressure of which has been brought to a minimum by pumping. The interspace between the vessels is filled with He. He is brought into contact with the C under a pressure of several atm.; the produced heat of adsorption is conducted through the He of the interspace to the liquid H. The He of the interspace is then removed whereby the thermal insulation of the vessel with C and adsorbed He is effected. By pumping off the He from the C the temp. sinks considerably. The lowest temp. reached was well below 4° abs. as indicated by measurements of the supraconductance of a Pb rheostat. The lowest pressure was 10^{-5} mm. Hg. The gap between the b. ps. of N and H can also be bridged by the same principle. EMIL KLARMANN

Determining temperature distribution. S. WHITEHEAD. *Electrician* **99**, 225 (1927).—The mathematical evaluation of the flow of heat in isotropic media. C. G. F.

Calculation of the theoretical combustion temperatures. PAUL DROSSBACH. *Z. Elektrochem. angew. phys. Chem.* **33**, 349-50(1927).—The temp. reached by burning CO with the equiv. amt. of pure O_2 was calcd. on the assumption that the heat of reaction at room temp. T , is equal to the integral $\int_T^{T'} C_P^{CO_2} dT$ plus the product αQ , in which

Q is the heat of disson. of CO_2 at the temp. T' and α is the percentage CO_2 dissond. Since Q can be expressed as a function of the sp. heats of the substances involved and the sp. heats, theoretically at least, as functions of the temp., it is possible to calc. T' . In this instance, the calcn. was made by successive approximations, tabulating the value of $\int_T^{T'} C_P^{CO_2} dT + \alpha Q$ for different values of T' , using the data of Miething, Nernst

and Landolt-Bornstein. For the combustion of CO with pure O_2 the calcd. temp. of combustion is 2811° and with air 2237° . For H_2 with pure O_2 the temp. of combustion is calcd. as 3527° and with air 2410° . These values are higher than those given by Pollitzer (cf. *C. A.* **17**, 2222), who uses disson. values at 0.1 atm. instead of 1 atm.; and further they do not agree with the Chemiker-Kalender, the figures from which, according to Drossbach, lead to absurd conclusions. A. W. KENNEY

Thermobalance analysis of the change in various compounds heated in different gases. HEIKICHI SAITÔ. *Sci. Repts. Tôhoku Imp. Univ.* **16**, 47-200(1927); cf. *C. A.* **21**, 1744.—Using an improved form of Honda's thermobalance S. investigated the wt. changes which occur when solids are heated under given conditions. Various natural and artificial sulfates, carbonates, sulfides, oxides and metals were examd. and the weight changes during continuous heating registered by means of the thermobalance. The materials were pulverized and reduced to the same av. grain size (200 mesh). Quantities of 0.5 g. (sometimes 0.3 or 1 g.) were then heated while a current of gas (air, air + SO_2 , N_2) was passed over the sample at the rate of 100 cc. per min. The rise in temp. was usually maintained at 2° per min. In some cases the heating was carried out in steps, i. e., at rapidly rising and then constant temps. The results are presented in numerous tables and graphs. The importance of continuous observation during heating for the industrial and metallurgical roasting of sulfide ores is illustrated. In those cases where the changes in weight were the result of simultaneous increase in weight (sulfate formation) and decrease of weight (oxide formation) the changes in the gas phase were also detd. and lixiviation tests were made. A thorough qual. and quant. study of continuous changes in solids can thus be established, for which S. proposes the new term "thermobalance analysis." H. S. VAN KLOOSTER

Thermal properties of ferric oxide. GEO. G. BROWN AND C. C. FURNAS. *Trans. Am. Inst. Chem. Eng.* **18**, 309-46(1926).—"The known sp. heat of cryst. Fe_2O_3 is extended from 100° to 650° . A new allotropic transformation at 360° is reported, and the heat absorbed at this transition is reported as 4.85 cal. per g. The total heat absorbed for all transitions between 650° and 825° is estd. at 41.8 cal. per g." Advantages and disadvantages of the method for detg. the thermal properties of solids are given. The app. and its operation are described. Numerous curves and charts and a bibliography are included. W. H. BOYNTON

The thermal and electrical conductivity of a single crystal of aluminum. EZER GRIFFITHS. *Proc. Roy. Soc. (London)* A115, 236-41(1927).—An Al crystal grown according to Carpenter (cf. *C. A.* 20, 3419) was examd. for elec. and thermal cond. For the thermal detns. thermocouples were clipped on to the crystal, one end was elec. heated and a differential-flow calorimeter measured the heat arriving at the other end. The crystal was lagged with sil-o-cel and a circular shield having the same temp. gradient as the crystal. The shield was lagged with magnesia asbestos. An extruded Al bar gave the same value of K in the app. as in the standard. K in c. g. s. units was 0.551 at a mean temp. of 76.4° , 0.557 at 163.9° . These values agree with that of the bar and are higher than earlier detns., because of higher purity (99.6% Al). The change with temp. is too slight to have any definite significance. The elec. sp. resistivity, detd. by means of a potentiometer, was 2.89×10^{-6} ohms per cm. cube at 18° . The Lorentz const. ($K/\lambda T$, where K is thermal cond., λ is elec. cond., and T abs. temp.) is 5.46×10^{-9} , which is within the range of published values. R. L. HERSHEY

Experiments and studies of Volta on the uniform expansion by heat of air and water vapor and on vapor pressures. F. MASSARDI. *Naturwissenschaften* 15, 705-10 (1927). B. J. C. VAN DER HOEVEN

The specific heat of tungsten, boron, boron nitride and beryllium oxide. A. MAGNUS AND H. DANZ. *Ann. Physik* 81, 407-24(1926).—The heat capacities in cal. per gram atom over the range $400-900^\circ$ are $WC_p = 6.7807 + .0010475t$; $BC_p = 2.3658 + 7.908 \cdot 10^{-3}t - 4.902 \cdot 10^{-6}t^2$; $BN_c = 2.516 + 6.31 \cdot 10^{-3}(t - 22) - 3.29 \cdot 10^{-6}(t - 22)^2$; BeO $3.089 + 7.464 \cdot 10^{-3}t - 4.786 \cdot 10^{-6}t^2$. The measurements were made in a large anaerobic calorimeter by the drop method. C_v for W is calcd. and is much above the theoretical value of 5.98. The other substances have not reached 5.98 at the highest temps. measured. F. R. BICHOWSKY

The temperature coefficient of the dielectric constant of quartz, fluorspar and gypsum. ALBRECHT DIETERICH. *Ann. Physik* 81, 523-36(1926).—The change in capacity of a condenser on changing temp. was measured at the frequency 6.5×10^4 . The temp. coeffs. of the dielec. const. $1/\epsilon(\delta\epsilon/\delta t)$ are: fluorspar 2.05×10^{-4} ; gypsum 3.75×10^{-4} (\perp , 010); Scholt's Minosglas 1.37×10^{-4} ; quartz 0.2×10^{-4} (\perp to axis). F. R. BICHOWSKY

Specific heat of gaseous nitrogen tetroxide. J. D. MCCOLLUM. *J. Am. Chem. Soc.* 49, 26-39(1927).—The apparent sp. heat of N_2O_4 was measured over the range in which it dissociates into NO_2 . The apparent sp. heat involves the heat of disson.; correcting for this the true heat capacity of the mixed N_2O_4 and NO_2 varies from 11.4 cal. per mol. at 34° to 19.5 at 160° . The heat capacities of the pure gases were not calcd. but must be about the same. F. R. BICHOWSKY

Thermal investigation of some olefin and acetylene derivatives. W. A. ROTH AND FR. MÜLLER. *Ber* 60B, 643-5(1927).—The heat of combustion per mol. at const. vol. at 20° of solid tetramethylbutenediol, $C_8H_{14}O_2$, is 1411 ± 5 kg. cal.; of (malenoid) α -tetramethylbutenediol, $C_8H_{16}O_2$, 1171 ± 3 kg. cal.; of (fumaroid) β -tetramethylbutenediol 1174 ± 1 kg. cal. F. R. BICHOWSKY

Specific heats of a highly cooled, non-condensed phase. N. PERRAKIS. *Compt. rend.* 184, 28-30(1927).—Starting from the revised form of Trouton's rule, P. has confirmed, by means of simple thermodynamical considerations, Perrin's conclusion that all gases cooled sufficiently have mol. heats equal to those of monatomic gases. B. C. A.

Reconciliation of values obtained for thermochemical constants of organic compounds. W. SWIENTOSLAWSKI. *Rocz Chem.* 6, 578-702(1926).—Values obtained for the heats of combustion of various org. compds. by different authors are compared and correction coeffs. detd. for them. B. C. A.

A critical study of the electrical differential method for measuring the specific heat C_p of a gas. MAX TRAUTZ. *Ann. Physik* 83, 457-97(1927).—The principle of elec. differential for measuring C_p of gases has been developed to a final equation for practical use. The cases of an ideal gas with and without dependence on temp. and an actual gas dependent on temp. are treated mathematically. The null method of a differential manometer is tested and it is shown how deviations occur exptly., what errors occur and how to correct for, or overcome them. Materials having a vapor pressure of at least a few mm. of mercury give C_p to an accuracy of about 1 to 5 percent in the app. used. R. H. LAMBERT

The heat of transformation of nickel and cobalt. SABURO UMINO. *Science Repts. Tohoku Imp. Univ.* 16, 593-611(1927).—U. studies the change in sp. heat and heat content of Ni and Co in the vicinity of their transformation points using a calorimeter and working in an atm. of H_2 . Curves are given showing the heat-content of Ni from

250° to 600° and of Co from 350° to 600° and from 1000° to 1300°. Curves are also given for the mean and true heats of Ni and Co from 100° to 1300°. The heat of magnetic transformation in Ni at about 400° was found to be 2.01 cal. per g. The heat of transformation in Co at 460° from hexagonal close-packed to face-centered cubic lattice was 1.05 cal. per g. and at 1150° the heat of magnetic transformation was found to be 2.00 cal. per g.

D. H. POWERS

The heat of adsorption of gases by charcoal. S. J. GREGG. *J. Chem. Soc.* 1927, 1494-1512.—The heats of adsorption, the equil. pressure and the amt. adsorbed of N_2O , C_2H_2 , C_2H_6 , CO , SO_2 , CO_2 , C_2H_4 and N by a standard birchwood charcoal were measured at 0° with a Bunsen ice calorimeter. A few expts. at 40.35° were made in a phenol calorimeter. The phenomenon of hysteresis was traced to the presence of some non-condensable gas in the adsorption system. For the integral heat of adsorption Q , the relationship $Q = kx^n$ was found to hold, where x is the amt. adsorbed and k and n are consts.; n is characteristic of the gas and lies between 0.9 and 1.0. The Williams-Henry equation, $\log x/p = A_0 - A_1x$, where p is the equil. pressure and A_0 and A_1 are consts. at const. temp., is fairly satisfactory. The relationship between p and Q is fairly well expressed by an equation of the form $Q = B \log (p/\alpha + 1) + A$. A close parallelism exists between the value of α and the corresponding values of the consts. a and b of the van der Waals equation.

R. L. DODGE

Heats of adsorption on poisoned and heat-treated catalysts. G. B. KISTIAKOWSKI, E. W. FLOSDORF AND H. S. TAYLOR. *J. Am. Chem. Soc.* 49, 2200-6(1927).—Measurements were made of the heats of adsorption of H on an active Cu catalyst and on the same catalyst after 2 successive reductions in activity by suitable heat treatment at 250° and 300°. The measurements were made in a special glass vacuum calorimeter described by T. and K. (cf. *C. A.* 21, 2088). An accuracy of 10% is claimed. The active catalyst showed maxima in the curve of heat of adsorption plotted against amt. adsorbed. The first heat treatment reduced the heat developed at the max. and also decreased the amt. adsorbed. The second heat treatment eliminated all evidence of a max. These results are in harmony with a theory of catalytic surface with variable elementary spaces, upon the most active of which adsorption is accompanied by an endothermic activation process, possibly a dissociation into atomic H.

R. L. D.

Adsorption. XII. The heat of adsorption of carbon dioxide. A. MAGNUS AND W. KALBERER. *Z. anorg. allgem. Chem.* 164, 345-56(1927); cf. *C. A.* 21, 844.—A calorimeter for measuring the heat of adsorption of small amts. of gas at low pressures and 0° is described in detail. The mol. heat of adsorption of CO_2 by wood charcoal increased rapidly with decrease in equil. pressure below 5 mm. Hg. The mol. heat of adsorption at equil. pressures above 5 mm. was about 7450 cal., but at 0.076 mm. had increased to 12,460 cal. The results are in agreement with Magnus' theory (cf. *C. A.* 20, 3368) which postulates the existence of points of high adsorption potential on the charcoal surface. **XIII. The heat of adsorption of carbon dioxide on silica gel.** *Ibid* 357-65.—Measurements of the heat of adsorption of CO_2 on silica gel at low pressures were made in the previously described app. The heat of adsorption decreased linearly with increase in equil. pressure. The results can be almost quantitatively explained as due to the Joule-Thomson effect.

R. L. DODGE

Six-place tables of the Debye energy and specific heat functions. J. A. BEATTIE. *J. Math. Phys. Mass. Inst. Tech.* 6, 1-32(1926).—The values of $\frac{1}{3}UR^{-1}T^{-1}$ and of $\frac{1}{3}C_vR^{-1}$ have been computed as functions of the argument $x(=h\nu_m/kT^{-1})$, where ν_m is a frequency characteristic of the substance) in the range 0-24 in increments of 0.1. For values of x greater than 24, an error of less than one in the sixth significant figure is introduced by using $\frac{1}{3}UR^{-1}T^{-1} = 19.481818x^{-1}$, and $\frac{1}{3}C_vR^{-1} = 77.92727x^{-3}$.

B. C. A.

Thermodynamical theory of reversible electrodes. B. SZYSZKOWSKI. *Bull. intern. acad. Polonaise* 8A, 313-23(1926); *Science Abstracts* 30A, 446.—A description is given of the application of the laws of thermodynamics to the problem of the equil. between an electrode and a soln. of electrolytes.

H. G.

A computation of the free energy and fugacity in gaseous mixtures of ethylene and argon. G. E. GIBSON AND BENJAMIN SOSNICK. *J. Am. Chem. Soc.* 49, 2172-9(1927).—As a test of the Lewis-Randall rule that the fugacity of a constituent in a mixt. of gases is the product of the mol. fraction and the fugacity of the pure constituent at the pressure of the mixt., the fugacities of C_2H_4 and A were calcd. from the exptl. data of Masson and Dolley (*C. A.* 17, 2804). The rule has been found to be valid at low pressures, but at higher pressures (50 atms.), the error of the fugacity calcd. by the rule ranges from 0 to 20%, depending upon the mol. fraction. At 100 atm., the errors range from 0 to 100%.

J. H. PERRY

The Volta effect. EMMANUEL DUBOIS. *Compt. rend.* 185, 110-1 (1927); cf. *Compt. rend.* 184, 1424 (1927).—When a metal is heated to a sufficiently high temp., it always becomes electronegative relatively to its initial state. D. suggests these variations in the Volta effect may be due to elimination of impurities by heating and that pure metals may be free from Volta effect. Preliminary results of a systematic investigation into the nature of the impurities causing the Volta effect showed that the oxidizability of the metal seems to be without influence, and also that on distg. *in vacuo* an alkali chloride over a metal which had previously been rendered electronegative (relative to its initial condition) by heating *in vacuo*, the metal becomes strongly electropositive.

A. PAPINEAU-COUTURE

An inexpensive and accurate gas chain for liquids lighter than saturated potassium chloride solution. H. C. WATERMAN. *J. Assoc. Official Agr. Chem.* 10, 390-5 (1927).—A simple design of sharp-junction H-electrode vessel of the bubbling type is described, one form of which can be set up without any glass blowing from materials available in almost any lab. The advantages of the vessel are low cost, rapid manipulation, freedom from KCl contamination of the soln. under examn., exclusion of atm. CO₂, small vol. of sample, and accuracy. Results with 0.05 M K H phthalate as test soln. show uniformly less than 0.01 p_H variation from the theoretical value for this soln. as given by Clark.

A. PAPINEAU-COUTURE

Current density-potential curves of metals that become passive, with iron described as an example. W. J. MILLER. *Monatsh.* 48, 61-70 (1927).—On the basis of time relations, current-potential curves for the passivation of Fe are obtained. These consist of 2 branches, one corresponding to the behavior of the active, the other of the passive metal. Earlier curves, prepd. without consideration for time, give the behavior of a metal which can be either active or passive, and are unsuitable as a basis for theoretical discussion.

H. STOERTZ

Influence of pressure on electrical conductivity of platinum. A. MICHELS AND P. GEELS. *Proc. Akad. Wetensch. Amsterdam* 29, 1106-12 (1926).—A Pt resistance thermometer was used and its resistance detd. at 15.57°, 21.95° and 34.75° at pressure intervals up to 251.5 kg./sq. cm. The results differ from previously published data in that the pressure coeffs. vary more considerably with the pressure, and at lower pressures the coeff. varies to a greater extent with the temp. The importance of this for the measurement of temp. by means of the Pt resistance thermometer is pointed out.

B. C. A.

The current density of a normal cathode fall. R. SEELIGER AND M. REGER. *Ann. Physik* 83, 535-64 (1927).—A study of the normal cathode fall has been made from the c. d. by evenly and totally covering the cathode. A series of expts. in H₂ and in N₂ show that the normal c. d. is not const. with pressure. This is due to an uneven coating about the cathode. The current strength is a linear function of the length of the covering of the cathode. Expts. were also made with neon and various metals were used as cathode for the three gases studied. Mixts. of 2 gases at a given pressure gave values that were not a linear function of concn. of either gas.

R. H. L.

A source of error in conductivity measurements. F. A. SMITH. *J. Am. Chem. Soc.* 49, 2167-71 (1927).—S.'s results confirm the conclusions of others and show that the cell const. is dependent on the resistance of the solns. used in its measure. Thus, it should be used with solns. having resistances of the same order of magnitude, as shown by cond. curves of NH₄NO₃ in liquid-NH₃ soln. From a plot of the ratio of the resistances of distant to concentric electrodes against the log of resistances of the distant pair, for solns. of NH₄NO₃ and NH₄Cl in liquid NH₃ and KCl in H₂O, it is evident that the resistance of the distant pair increases more rapidly than that of the concentric, until the limiting value of the former is reached. If other factors are const., the ratios of resistances are, still, not the same.

J. BALOZIAN

Cells of the standard cell type with low electromotive forces. W. C. VOSBURGH. *J. Am. Chem. Soc.* 49, 2222-9 (1927); cf. *C. A.* 20, 327.—The c. m. fs. of the following cells are measured: Cd(Pb,Hg)/CdCl₂.2.5H₂O, sat./CdCl₂.2.5H₂O + PbCl₂, sat./Pb(Hg) (I), and, Cd(Pb,Hg)/CdI₂, sat./CdI₂ + PbI₂, sat./Pb(Hg) (II), at 25° over 8-9 months, until constancy is assured, and then at 5° intervals from 15-40° over 3-14 days. Both cells have large temp. coeffs., I showing a transition point at 26.2°, below which the coeff. is negative and above, positive. Cell II shows marked hysteresis. For these reasons neither is suitable for a standard. The heats of reaction are calcd. and compare favorably, in some cases, with those calcd. from thermochem. data.

J. B.

The potential of the gold-auric oxide electrode. R. H. GERKE AND M. DOROTHY ROURKE. *J. Am. Chem. Soc.* 49, 1855-8 (1927).—The Au₂O₃ used is prepd. by Krüss's method (*Ann.* 237, 291 (1887)), and Au (cryst.) by reducing AuCl₃ with SO₂. The

e. m. f. of the cell H_2 (1 atm.), H_2SO_4 , $Au_2O_3(s)$, Au (cryst.) is calcd. from those observed for $Hg(l)$, $Hg_2SO_4(s)$, H_2SO_4 , $Au_2O_3(s)$, Au (cryst.) and the known values of H_2 (1 atm.), H_2SO_4 , Hg_2SO_4 , Hg for 3 acid concns., by taking the av., and is found to be -1.362 v. (H^+). The free energy of formation of Au_2O_3 is calcd. as 18,810 cal. Although there are no theoretical reasons why Au_2O_3 can or cannot be prepd., G. and R. doubt that it has ever been made pure.

J. BALOZIAN

The poisoning of hydrogen electrodes. I. A. H. W. ATEN, P. BRUIN AND W. DE LANGE. *Rec. trav. chim.* **46**, 417-29 (1927).—Among the substances considered as poisons towards the H electrode are NH_3 , H_2S , cyanides, As compds. and Hg salts. In cases of poisoning the potential of the electrode towards the soln. is always too positive. Traces of O have a great influence on the poisoning effect. Electrodes of sheet Pt, or of Pt wire, either covered with bright Pd from a soln. of $PbCl_2$ or coated with Pt black were examd. in pure H, in the presence of As_2O_3 , and in the presence of O. It was difficult to prep. electrodes of the same activity, even when the same method of prepn was used. Two types of poisoning were observed—acute, from which the electrode recovered in a short time, and permanent, which went on increasing for several days. The poisoning action of As_2O_3 depended on the following factors: surface conditions of the electrode, area of the electrode, presence or absence of O, agitation of the soln., and nature of the electrolyte. $HgCl_2$ behaved like As_2SO_3 . H_2S and KCN had only a slight poisoning action.

R. L. DODGE

Studies in overvoltage. II. Oxygen overvoltage. TADASHI ONODA. *Z. anorg. allgem. Chem.* **165**, 79-92 (1927).—Using an app. previously described (cf. C. A. **21**, 695; *Z. anorg. allgem. Chem.* **162**, 57 (1927)) O detd. between 0.3° and 60° the O overvoltage (π) on electrodes of polished Pt (I) $\pi_{2.0} = 1.663$, platinized Pt (II) 1.441, Au (III) 1.6932, polished Ni (IV) 1.405, Ni with Ni black (V) 1.3992 and Cu (VI) 1.465. π was independent of the history and treatment of the electrode surface at 0.3° as well as at 20° . The electrodes were treated for periods up to 10 days as follows: (I) and (II) H_2SO_4 , HNO_3 , HCl , $AcOH$, $NaOH$, NH_4OH , (III) HNO_3 , HCl , $AcOH$, air, $NaOH$, NH_4OH ; (IV) HNO_3 , NH_4OH , (V) Ni black disappeared when treated with acids and bases, (VI) Cu underwent discoloration, etc. The temp. coeffs. are (I) $\pi_t = 1.7355 - 0.0045t$; (II) $1.7664 - 0.00388t$; (IV) 1.3880 , $0.0019t - 0.000039t$; (II) and (IV) very small. H-O cells are not reversible between 0° and 60° ; the O overvoltage always exceeds 1.23 v. III. The relation of hydrogen overvoltage, surface tension and concentration of the solution. *Ibid.* 93-136.—Using a specially designed Hg electrode with electrolyte (I) 2 N H_2SO_4 contg. varying amts. of $(NH_4)_2SO_4$, Na_2SO_4 , K_2SO_4 , leucine, mannitol and $C_2H_5(OH)_3$ separately and (II) 0.1, 0.5, 1.0 and 2 N HCl contg. NH_4Cl , O. has detd. H overvoltages π . The surface tension of Hg in the presence of these solns. and some of 0.1, 0.5, 1.0 N H_2SO_4 contg. $(NH_4)_2SO_4$, Na_2SO_4 and K_2SO_4 separately were detd. in a U tube with arms of unequal diam. The overvoltage in (I) increases with increase in concn. of salt, in (II) it decreases. The surface tension behaves in the reverse manner in each case. The relation between the

change in π and γ (dynes) can be expressed $\Delta\pi = \Delta\gamma \frac{\partial\pi}{\partial\gamma} = -0.0065 \Delta\gamma$. With amalgams contg. 0.063, 0.033% Au, 0.1, 0.0178% Ag, 0.1435, 0.0357% Pb, and 0.1% Zn it was found that the same generalizations obtained. There is no simple relation between the H overvoltage and the surface tension of H in solns. of the various acids contg. salts. Descriptions and drawings of the app. are given.

E. R. S.

Nature of the film produced by anodic oxidation of aluminum. H. SUTTON AND J. W. WILLSTROP. *J. Inst. Metals* **440** (advance copy), 5 pp. (1927); cf. C. A. **21**, 2444.—Anodically treated strips of Al were placed in a silica boat contd. in a hard glass tube. Dry HCl passed over the strips at $300-320^\circ$ removed the Al and left the film. Films varying in thickness from 0.033μ to 2μ were obtained. Si and C were found in the films. From the vol. of gas evolved when the treated Al strips were heated *in vacuo* to 1200° the film is shown to be oxide and not hydroxide.

J. W. S.

Development of an exponential equation for the preparation of spark potentials from an experimental basis by considering an electrode function. II. Determination of the ionization values α - β and $(n.v.)$ from the electrode function. FR. KLINGEL-RUSS. *Ann. Physik* **83**, 565-74 (1927).—The coeffs. of the exponential equation α and β are detd. either from 2 spark gaps or where one is equal to zero. These consts. vary with the diameter of the bulb which does not agree with the theory of ionization of gases. By assuming that for $Q = 0$, in the electrode function, the independent discharge in unit vol. of existing carrier at the time t has the same value as for produced carrier per unit vol. in the very small time $t - t_0$, good agreement is attained

with existing data for spark gaps from 1 to 40 cm. Deviations of expt. from calcn. for variant size of bulb must still be explained. R. H. LAMBERT

The dependence of the dielectric constant of vapors upon temperature. I. Benzophenone. FRITZ MASKE. *Physik. Z.* 28, 533-45(1927).—From the change in capacity of a gas condenser produced by the presence of Ph_2CO vapor M. has detd. the dielec. const. ϵ of this substance. $(\epsilon - 1)_{760}^{\text{mm.}} = 0.0205 \pm 1.5\%$; $(\epsilon - 1)_{760}^{226^\circ} = 0.0295 \pm 1\%$. At high temps. ϵ approaches a const. value; at low temps. it rises rapidly. The relation is expressed by $\frac{(\epsilon - 1)}{(\epsilon + 1)^2} \cdot \frac{1}{d_n} (T - T') = K$, in which T is temp. of measurement; T' 414° abs.; $d_n = d_{760}$. Vapor pressures of Ph_2CO detd. by boiling at reduced pressures and by introduction in a vacuum over Hg for temps. 140 – 226° are, for intervals of 10° , 0.98, 1.05, 1.4, 1.8, 2.4, 3.2, 4.25, 5.7, 7.6 and 8.85 cm. (226°) resp. Drawings and description of app. are given. E. R. SCHIERZ

Dielectric constant of "rod-like-particle" sols. J. J. BIKERMAN. *Physik. Z.* 27, 769-71(1926).—A statistical computation of the orientation of ellipsoids in a homogeneous elec. field has been made, and the conclusions have been applied to the behavior of V_2O_5 sols with rod-like particles (cf. *C. A.* 19, 1528). B. C. A.

The electrical anisotropy of liquid crystals. MIECZYSLAW JEZEWSKI. *Z. Physik* 40, 153-60(1926); cf. *C. A.* 18, 2102.—The measurements of the dielec. consts. of *p*-azoxyanisole and *p*-azoxyphenetole in a magnetic field which were reported in a previous paper were carried out under more accurate conditions. The difference between the dielec. consts. observed in the magnetic field and outside of it depends upon the temp. It decreases in the case of *p*-azoxyphenetole from 0.28 at 138.7° to 0 at 170° and in the case of *p*-azoxyanisole from 0.16 at 120.6° to 0 at 135.5° . A series of measurements has been carried out to det. the influence of the angle between the magnetic and elec. lines upon the dielec. const. The results obtained agree very closely with those calcd. from the equation: $\epsilon_\alpha = \epsilon_0 \cos^2 \alpha + \epsilon_{90} \sin^2 \alpha$. An agreement with the data calcd. from Ornstein's equation (cf. *C. A.* 18, 2827) was obtained only in the case of high field intensities. EMIL KLARMANN

The thickness of the Helmholtz double layer. J. F. MCCLENDON. *Science* 66, 200(1927).—The surface of a charged metal electrode immersed in an electrolytic soln. and the layer of excess ions of opposite sign act as the plates of a condenser the capacity of which can be measured. This capacity in microfarads is $C = 0.0885 \times 10^{-6} K S/T$ where K is the dielec. const., S is the surface area of the electrode in sq. cm. and T is the thickness of the dielectric (Helmholtz double layer). The cond. cell used to det. the capacity contained two Au electrodes each of 10 sq. cm. surface (5 sq. cm. face and 5 sq. cm. back) and acted as 2 condensers in series equiv. to one condenser with double the thickness of dielectric. Assuming $K = 80$ the equation becomes $T = 7.08 \times 10^{-6}/C$ in cm. and the thickness of the Helmholtz layer is $T/2$. The electrostatic value of the capacity could be only approx. detd. since it changed slightly with the a. c. frequency. The thickness of the Helmholtz layer increased with diln. and was found to be 0.194×10^{-6} cm. for 0.1 *N* KCl soln. and 0.325×10^{-6} for 0.001 *N* KCl soln. E. R. SMITH

Optical rotatory dispersion. III. The rotatory dispersion of quartz in the infra-red, visible and ultra-violet regions of the spectrum. T. M. LOWRY AND W. R. C. COODE-ADAMS. *Trans. Roy. Soc. London A* 226, 391-466(1927); cf. *C. A.* 16, 3581.—Previous work on the rotatory dispersion of quartz (*C. A.* 9, 1003) is now extended to include the wave-length interval from 25,170 Å. U. in the infra-red to 2327 Å. U. in the ultra-violet. Photographic methods using the line spectra of various elements were employed for the visible and ultra-violet regions. For the infra-red region galvanometer readings were made on continuous spectra. The most important result of the expts. has been to establish the complete validity of Drude's equation for the rotatory dispersion of transparent media, namely, $\alpha = \Sigma k_n/(\lambda^2 - \lambda_n^2)$. In the present work the dispersion consts. to be used in this equation for quartz are calcd. directly from the observed rotations and not from measurements of absorption or refraction. The formula derived for the rotatory power of quartz at 20° is $\alpha = [9.5639/(\lambda^2 - 0.0127493)] - [2.3113/(\lambda^2 - 0.000974)] - 0.1905$, which will give the rotation to $\pm 0.002^\circ/\text{mm.}$ for any point in the spectrum within the limits stated above. C. C. KISS

Notes on the energy of vibration of carbon monoxide and carbon dioxide molecules. FRANK MATOSI. *Z. Physik* 40, 1-3(1926).—The deformation of the molecules of CO and CO_2 was calcd. from their elec. momentum. In both cases the values are considerably smaller than the ones calcd. from the mol. refraction. E. K.

The optical anisotropy of selectively absorbing dyestuffs. H. ZEHNER AND FRIEDRICH C. JACOBY. *Kolloidchem. Beihefte* 24, 365-417(1927); cf. C. A. 20, 699.—The data on the relation between dichroism and double refraction and the optical peculiarities of selectively absorbing substances are reviewed (19 citations). By applying the rules for anomalous dispersion to each of the 2 directions of vibration of the light traversing an anisotropic layer, the course of the double refraction throughout the spectrum was traced for the several possibilities of dichroism. In the case of simple dichroism the more strongly absorbed ray is more strongly refracted in the spectral region of wave lengths longer than the wave length of max. absorption, and less strongly in the region of shorter wave lengths. Exptl. verification of the deduction was made by studying dyes that had been rendered anisotropic by four different methods. About 160 different dyes were obtained anisotropic. Three-fourths of these exhibited simple dichroism. Dyes made anisotropic by polishing in the dry state usually show positive dichroism, those polished moist show negative dichroism. Sometimes the reversal of direction takes place in only a part of the spectrum. F. L. BROWNE

Molecular refraction and the parachor. W. HERZ. *Z. anorg. allgem. Chem.* 159, 316-8(1927).—Calcs. are made of the mol. refraction and of the parachor for 51 org. liquids, from values previously published. The quotient of the parachor divided by the mol. refraction is a const., independent of the liquid. Abnormal values were obtained for liquefied gases. A close relation between n and surface energy is indicated. B. C. A.

The lag of the Kerr effect. J. W. BEAMS AND E. O. LAWRENCE. *Proc. Natl. Acad. Sci.* 13, 505-10(1927).—By means of a special exptl. arrangement the following values for the time lag in the Kerr effect (double refraction by a liquid in an elec. field) are detd.: CHBr_3 3.3×10^{-9} sec., CHCl_3 3.8×10^{-9} , Et_2O 6×10^{-9} and CS_2 and benzene less than 2×10^{-9} . For a given liquid the lag is independent of the wave length of the light. Since the time lag is roughly proportional to the permanent elec. moment of these mols., it is suggested that only polar mols. can exhibit lags as great as 10^{-9} sec. An effect of temp. on the lag in CHCl_3 was found, the lag being about 2×10^{-9} sec. longer for the liquid at -5° than at 25° . The results partially support the orientation theory of the Kerr effect, but several phenomena are not explained by this theory. F. A. JENKINS

Refractometric evidence for the existence of undissociated molecules and complex ions in solutions of strong electrolytes. K. FAJANS. *Trans. Faraday Soc.* 23, 357-81 (1927).—The relationship $(\Delta R)r^4 = k$ holds between the decrease in refractivity ΔR suffered by a halogen ion in the alkali halide lattice and the lattice distance r . The const. k for the ions I^- , Br^- , Cl^- is approx. proportional to the square of their respective refractivities. The refractivity of salts and of HCl changes with increasing concn. analogous to the changes which accompany the union of the ions into crystals or mols. These changes are in all cases attributed to the polarizing action of the ions on each other. It is concluded that in solns. these changes must be caused by such oppositely charged ions as are in direct contact with each other with no water mols. between them. From the refractivity data it follows that in soln. the least distance to which a Cl ion can approach a cation is greater for Na ion than for Li ion. Since the characteristic parameter introduced into the theory of Debye and Hückel has a greater value for Li ion than for Na ion, this parameter can hardly have the phys. significance ascribed to it by the theory, i. e., that of the distance of nearest approach of the ions. From a comparison of the partial vapor pressures of HCl and HCN from their aq. solns. it is concluded that up to concns. of about 5 mols. per 1000 g. of H_2O the decrease in refractivity of HCl with increasing concn. is due only to a very slight extent to the formation of undissoc. HCl , possibly being caused by the complex ion H_3Cl^+ . For higher concn. the equil. is strongly shifted in favor of the undissoc. HCl . E. R. SMITH

The dispersion at the extreme temperatures of the liquid state. W. HERZ. *Z. anorg. allgem. Chem.* 163, 217-20(1927).—If in the Lorentz-Lorenz formula $SR = [(n^2 - 1)/(n^2 + 2)] \cdot (1/d)$, SR is assumed to be independent of the temp., it is possible to calc. n for any given temp., providing the corresponding d is known. Using data taken from the literature, H. calcs. the n_D , n_F and n_C of 25 substances at 0°K and at their crit. temp. In every case he finds that $n_{C_0} - n_{C_\infty} < n_{D_0} - n_{D_\infty} < n_{F_0} - n_{F_\infty}$. A. L. HENNE

Phosgeno-aluminates of Li , Mg , K and Pb (BIROSEL) 6. The lattice constant of metallic Co (SEKIRO) 9. The surface tension of molten metals and alloys (MATUYAMA) 9. Adsorption and its relation to refrigeration (KEYES) 13.

- BANCROFT, WILDER D.: **Contact Catalysis**. New York: Columbia Univ. Press. 15 pp.
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3—SUBATOMIC PHENOMENA AND RADIOCHEMISTRY

S. C. LIND

- New mechanics**. LUDWIG FLAMM. *Naturwissenschaften* 15, 569-78(1927).—A review of Schrödinger's wave mechanics. B. J. C. VAN DER HOEVEN
- Electricity and matter**. W. S. JOHNSON. *J. Chem. Education* 4, 1088-97(1927). E. H.
- The detection of eka-manganese**. N. SEL'YAKOV AND M. KORSUNSKI. *Physik. Z.* 28, 478-9(1927).—Polcmical F. O. A.
- The relation between the formation of complex salts and the structure of the central atom**. H. LESSHEIM, J. MEYER AND R. SAMUEL. *Z. Physik.* 43, 199-221(1927).—Using the electronic structure of the central atom as a starting point, the authors try to establish the systematics of the complex salts. Empirical rules and regularities in the properties are found. The mag. magnetic properties follow these rules. A. L. HENNE
- The number representing the valency and its relation with the structure of the atoms**. HANS LESSHEIM AND RUDOLF SAMUEL. *Fortschritte Chem., Physik, physik. Chem.* 19, No. 3, 7-98(1927).—A general up-to-date survey of the subject presented in a non-mathematical way. As an introduction, the authors summarize the fundamental postulate of the quantum theory, the Bohr H model, the atomic models of Bohr and those of Stoners, and the natural system of the elements. The first part of the work is a study of the Köntgen spectra; it leads to a discussion of the composition of the outer atomic shell, with special attention to the alkaline metals. The second part considers the polar and non-polar linkages and their importance in the building of the mols. The last part of the work studies the chem. properties of the atoms as a result of their constitution. A. L. HENNE
- A possible significance of the tetrahedral numbers in the natural system for the arrangement of protons and electrons in the atoms. II**. HUGO STINTZING. *Z. Physik* 40, 92-106(1926); cf. *C. A.* 20, 1754.—The scheme of tetrahedral numbers affords a deductive working hypothesis in the absence of a satisfactory theory of nuclear structure. It disregards for the present the nature of forces within the nucleus

of the atom. The tetrahedral theory was applied in a previous paper to the at. wts.; now it is extended to electrons. The new tetrahedral hypothesis points to the improbability of the occurrence of elements with the masses 2, 3, 5, 13 and 21 and permits, entirely in agreement with facts, the assumption of elements with other masses and their isotopes. It suggests the existence of an element 93 in the Mn group; the existence of an element 94 or higher is improbable. The γ -radiation (Barkla) can be explained on the basis of this theory.

EMIL KLARMANN

The hydrogen and helium models. FELIX JOACHIM V. WISNIEWSKI. *Z. Physik* **44**, 385-91 (1927).—In the calcn. of the ionization potential and the magnetic susceptibility of H and He, on the ground of the author's theory (*C. A.* **20**, 2780), the model of the diatomic gases may be used for the H mols., and the model of the monoatomic gases for the He mols. This is done without involving any modification of the theory. For a correct calcn. of the dielec. const., by means of these models, the equation defining the dielec. const. is to be modified in both cases in the same way. The new definition will consequently be common to H and He, but it will remain different from the various equations characterizing the other gases.

A. L. HENNE

The rotation energy of a diatomic gas. KOLOMAN SZELL. *Physik Z.* **28**, 546-9 (1927); cf. *C. A.* **20**, 2112.

MARIE FARNSWORTH

Undulatory theory of the mechanics of atoms and molecules. E. SCHRÖDINGER. *Phys. Rev.* **28**, 1049-70 (1926).—In the new theory, the existing discrepancy between the frequency of motion and the frequency of emission disappears in so far as the latter frequencies coincide with the differences of the former. A definite localization of the elec. charge in space and time can be associated with the wave system, and this with the aid of ordinary electrodynamics accounts for the frequencies, intensities, and polarizations of the emitted light and makes superfluous all kinds of correspondence and selection principles. In several cases, where the new theory is at variance with the old, the former is the better supported by expt.

B. C. A.

Undulatory mechanics and atomic structure of matter and of radiation. LOUIS DE BROGLIE. *J. phys. radium* **8**, 225-41 (1924); cf. *C. A.* **21**, 1220. —Most students of undulatory mechanics have tried to represent the dynamical phenomena by the propagation of waves with a continuous amplitude of the classical type in optics. At first it is difficult to comprehend how this point can be reconciled with the at. structure of matter and of radiation. The object of this paper is to show that continuous solutions furnish, in reality, only a certain static view permitting singularities. These conceptions give a clear sense to the equation proposed by Schrödinger for the dynamics of the system.

L. D. R.

Electronic states and band spectrum structure in diatomic molecules. IV. HUND'S theory; second positive nitrogen and Swan bands; alternating intensities. R. S. MULLIKEN. *Phys. Rev.* **29**, 637-49 (1927); cf. *C. A.* **21**, 206, 1057. —Hund's theory (cf. *C. A.* **20**, 2283) of mol. electronic states and band spectra is reviewed briefly. After a discussion of intensity relations and selection principles in terms of the correspondence principle, it is shown that the available evidence is in agreement with the theory. The occurrence of P -type S terms and σ -type P and D terms is explained by the theory, as also the existence of P -type and σ -type doubling. Selection rules and other relations in ${}^2P \rightarrow {}^2S$ and ${}^3S \rightarrow {}^2P$ transitions are discussed. Hund's interpretation of the second positive N_2 bands as a ${}^3P \rightarrow {}^3P$ transition is further developed and extended to the Swan bands; the apparent absence of Q branches, and other intensity relations in these bands, are explained; the rotational doubling in these bands is interpreted as σ -type doubling. The alternating intensities or alternate missing lines in the He_2 , N_2 , Swan, and N_2 bands can all be accounted for formally by the postulate that they are due to alternate (partially or completely) suppressed levels such that the suppressed values of $(j_k - \sigma_k)$ are always as follows: B rotational sub-states ($j - \frac{1}{2} - \sigma_k$) = 0, 2, 4, —; A sub-states 1, 3, 5, —; here σ_k is the part of σ which is due to the orbital angular momentum of the electron and j_k is the resultant of σ_k and the quantity m which measures the nuclear angular momentum in quantum units. The NH β bands (${}^3P \rightarrow {}^3S$) are briefly discussed. V. Bands of the violet CN (${}^2S \rightarrow {}^2S$) type. *Ibid.* **30**, 138-49. —Theoretical intensity formulas applicable to bands of the violet CN (${}^2S \rightarrow {}^2S$) type are obtained: P_1 or $R_1: i_1 = 2jk(j_k + 1)/(2jk + 1) = (j^2 - \frac{1}{4})/j$; P_2 or $R_2: i_2 = 2jk(j_k - 1)/(2jk - 1) = (j^2 - \frac{1}{4})/j$; $Q_{1,2}$ or $Q_{2,1}: i_3 = 2jk/(4jk^2 - 1) = (2j + 1)/4j(j + 1)$, with the help of the summation rules, assuming Hund's (*C. A.* **20**, 2283) case b type of interaction of the electron spin. The equations predict 2 Q branches ($Q_{1,2}$ and $Q_{2,1}$) hitherto unrecognized, which should appear as weak satellite series, one accompanying the familiar double P branch, the other the R branch. These Q branches should decrease in intensity from their first

members. The first $Q_{2,1}$ (or $Q_{1,2}$) line should accompany the otherwise single first line of the R (or P) branch, all other P and R lines being truly double; this is in agreement with Hulthén's (C. A. 21, 1227) results on the B bands of CaH. For low j values in the P and R branches, the doublet component corresponding to the parallel orientation (+ ϵ) of the electron spin vector should be appreciably more intense than that corresponding to the anti-parallel orientation (- ϵ). Treating the doublets (and their satellites) as unresolved single lines, the intensities should be exactly as in $^1S \rightarrow ^1S$ bands (CuH, HCl). The above predictions seem to be confirmed in the CaH, N_2^+ , and violet CN bands. Thus the theory appears to afford a satisfactory explanation of the observed lines and intensity relations in $^2S \rightarrow ^2S$ bands, removing previous difficulties and uncertainties in interpretation. Other $S \rightarrow S$ transitions are treated briefly. The nature of the energy differences between the 2S terms corresponding to + ϵ and - ϵ is considered. In all cases where the order of the terms can be determined, with the one exception of the initial states of the B bands of CaH, it is found that $F_1 > F_2$. This suggests that the magnetic field which causes $F_1 \neq F_2$ (developed by the mol. rotation in accordance with Kemble's theory) may be in part that of the nuclei as well as of the electrons.

BERNARD LEWIS

Radium, uranium and vanadium. F. L. HESS. *Mineral Ind.* 35, 601-10 (1926).—World sources and output are discussed, with notes on technology. A. BUTTS

Compton effect according to Schrödinger's theory. W. GORDON. *Z. Physik* 40, 117-33 (1926).—The quantum frequency and intensity of the Compton effect are found to be equal to the geometric mean of the corresponding classical magnitudes for the initial and final states in the process. B. C. A.

Hydrogen spectrum in the new quantum theory. C. ECKART. *Phys. Rev.* 28, 927-35 (1926).—Mathematical. The Born and Jordan matrices are calcd. Computed intensity ratios for the two brighter components of H_α and H_β are not in agreement with observed values, the discrepancy being too great to be ascribed to the incompleteness of the model. B. C. A.

New quantum theory and the Zeeman effect. P. S. EPSTEIN. *Proc. Nat. Acad. Sci.* 12, 634-8 (1926).—Mathematical. The difficulties encountered in the treatment of the Zeeman effect by means of Schrödinger's theory are avoided by a new derivation of the fundamental equation for the behavior of a H atom in a uniform magnetic field. It is claimed that this treatment is more rigorous, since the terms of the second order are not neglected, as in the older theory. B. C. A.

Quantum theory of the problem of two substances. J. R. OPPENHEIMER. *Proc. Cambridge Phil. Soc.* 23, 422-31 (1926); *Science Abstracts* 30A, 83-4.—An attempt is made to solve more generally than has previously been accomplished the quantum mech. problem of an ion and an electron. The methods of Schrödinger, using the characteristic functions of the wave equation $\Delta^2 u + (8\pi^2\mu/h^2)[E + (e^2/r)]u = 0$ are employed. The line intensities of the H spectrum are evaluated and a method is discussed for obtaining the radiation from hyperbolic orbits. The problem of the photoelec. and the inverse photoelec. effects is attacked and a formula obtained for the continuous absorption spectrum. The probabilities of transition, deflection and capture in a collision of an electron with an ion are computed. H. G.

Interaction of neutral atoms and homopolar binding according to the quantum mechanics. W. HEITLER and F. LONDON. *Z. Physik* 44, 455-72 (1927).—The action of forces between neutral atoms has a characteristic ambiguity in the quantum mechanics. The ambiguity seems capable of including the different modes of behavior actually found, i. e., for H either homopolar binding or elastic reflection, but for the rare gases only reflection. It also permits an evaluation of the elastic reflection effects in He, giving results of the right order of magnitude. For the selection and discussion of the various possible interactions the Pauli principle is here applied to a system of several atoms. F. A. JENKINS

A new scheme of atomic synthesis. MEGH NAD SAHA. *Physik. Z.* 28, 469-73 (1927).—By using well-known principles and without needing to assume any subdivision of energy levels, a simple scheme is developed with which the optical, chem. and ionization properties of the different atoms are correlated. The following levels are used together with the no. of electrons to fill them: K₁ 2, L₁ 2, L₂ 6, M₁ 2, M₂ 6, M₃ 10, N₁ 2, N₂ 6, N₃ 10, N₄ 14, O₁ 2, O₂ 6, O₃ 10, O₄ 14, P₁ 2, P₂ 6, P₃ 10, Q₁ 2, Q₂ 6; M₃ is placed to the right of N₁ and in the transition group the electrons are exchanged between these 2 levels. F. O. ANDEREGG

The structure of atomic nuclei. F. R. VOLOCHINE. *Compt. rend. séances soc. polon. phys.* 1925, 61-73; *Physik. Ber.* 7, 95.—In continuation of his previous work (cf. *Physik. Ber.* 4, 997 (1923)), V. considers the components of all nuclei as dynamic

systems with strong magnetic moments. The elementary components are represented by the prototypes H_2^1 , H_3^1 and H_4^2 (upper index = at. no.; lower = at. wt.). Thus H_2^1 and H_3^1 are isotopic with H_1^1 (H nucleus). $H_4^2 = \text{He nucleus} = H_A^Z = (3Z - 4)H_2^1 + (4 - 2Z)H_3^1$ (I). By an α transformation an element H_{A-4}^{Z-2} would be produced; a β change would yield H_A^{Z-1} . If $(Z - 2)$ and $(4 - 4)$ be substituted for Z and A , resp. in (I) it is found that the new element is composed of the same no. of H_2^1 and 2 less H_3^1 ($2H_2^1 = H_4^2 = \alpha$). From the supposed configuration of C = $2H_2^1 + 2H_3^1$; N = $2H_4^2 + 3H_2^1$; O = $3H_4^2 + 2H_2^1$ and the usual at. wts. the at. wt. of H_2^1 is calcd. as 2.008. $\text{Be}_9^0 = H_4^2 + H_3^1 + H_2^1$ yields the at. wt. of H_3^1 as 3.010. The energy evolved during the transformations is calcd. as 23.8×10^{-1} ergs and is available for kinetic energy of the α -particle, energy of disintegration or rearrangement. To explain the energy changes V. assumes the existence of quantum levels among which the H_2^1 , H_3^1 and H_4^1 can move about. Thus, when one moves to a lower level γ -radiation is produced. Of the energy available for rearrangement part can leave the nucleus as γ -rays. To show a quant. relationship between the α -, β - and γ -rays V. shows (1) that the additive rule holds not only for γ -rays, but also for energy differences of α rays (3 examples from Ra group); (2) of the 11 γ -rays of the Ra group the energy of 4 is identical with differences of α - and β -rays, that of 6 others equal to differences between 2 α - or 2 β -rays; (3) the energy of the β -rays corresponds to the differences between γ - or α -rays. Discussion of the structure of the elements is contained in the original. E. R. S.

An electron lattice theory of metals. B. E. WARREN. *Phys. Rev.* **27**, 797 (1926).—Metallic crystals are composed of ions and electrons, both being on definite lattices. The particular type of lattice must have a min. of potential energy. The rule is laid down that atoms with only 2 valence electrons will lose them, while atoms with more than 2 will lose only the excess. The metals of the various groups and comparison of the theory and x-ray results are discussed. Agreement is good. R. L. H.

The electric moment of the sulfur complex. A. M. TAYLOR AND E. K. RIDEAL. *Proc. Roy. Soc. (London)* **A115**, 589-609 (1927).—An infra-red examn. of several kinds of S shows the existence of electromagnetically active vibrations from which it is concluded that elec. doublets are present in the S complex. These are supposed to be the units S_2 which are built into groups $(S_2)_n$ of mass 512, fundamental in crystal structure. The linkage is thought to be pseudo-heteropolar. The elec. moment in *e. s. u.* $\times 10^{-18}$ and the effective charge on the atoms in fractions of the unit charge, resp., as calcd. by using the formula for extinction coeff. with absorption spectra data are 7.5 and 0.77, using the heat of vaporization in Kornfeld's formula are 8.0 and 0.82, while the approx. heat of dissoen. gives 4.5 and 0.46. For these calcns. the distance apart of centers of mass of the atoms is taken as 2.05 A. U. F. O. ANDEREGG

A new mass spectrograph and the whole-number rule. F. W. ASTON. *Proc. Roy. Soc. (London)* **A115**, 487-514 (1927).—With a new mass spectrograph (described in detail) possessing a resolving power of 1 in 600 and an accuracy of 1 in 10,000, new results have been obtained for the isotopic constitution of many elements. Mass nos., arranged in the order of intensity of the isotopes, have been found as follows for: S (32, 33, 34); Sn (120, 118, 116, 124, 119, 117, 122, 121, 112, 114, 115); Xe (129, 132, 131, 134, 136, 128, 130, 126, 124); Hg (202, 200, 199, 198, 201, 204). In addn., revised values of mass on the basis O = 16 are given for various elements or their more prominent isotopes. For each element studied is given its packing fraction, which measures the forces binding protons and electrons together in the nucleus. A plot of the packing fractions against mass nos. shows that all but light atoms lie on a single curve descending from a max. value for H to a negative min. for Br and then ascending again to a positive value for Hg. C. C. KIESS

The reflection of atomic hydrogen from ice crystals. T. H. JOHNSON. *Nature* **120**, 191 (1927).—A stream of at. H is allowed to be reflected from ice crystals oriented at random on to a photographic plate, the set-up of Phipps and Taylor (*C. A.* **21**, 526) being used. The preliminary results are interpreted as being in favor of the viewpoint that the diffractive nature of the reflection is assocd. with the momentum rather than with the structure of the colliding body. Some sort of selective reflections seems to be present at small angles. F. O. A.

The relation of the surface energies of different surfaces in rock-salt crystals. V. D. KUZNETSOV AND N. A. BESSONOV. *Z. Physik* **44**, 226-30 (1927).—It is experimentally detd. that the work necessary to grind off equally thick layers on the (100)

(110) and (111) planes of a rock-salt crystal is in the proportion $1:\sqrt{2}:\sqrt{3}$. Hence, the surface energies on these planes must be in this ratio. F. A. JENKINS

The age of the universe. J. H. SWARTZ. *J. Elisha Mitchell Sci. Soc.* **42**, 179-87 (1927).—The temp. of the stars cannot be satisfactorily accounted for by chem. changes, contraction or radioactivity, but can be by the transformation of mass into energy. Assuming the latter to be true, a formula for calcg. the age of a star is derived. The data obtained by the use of this formula together with other evidence indicate a max. age of 17.78 trillion years for our present stellar universe. A. L. MEHRING

Registering of α - and H-rays according to the new electrical counting method. H. GREINACHER. *Z. Physik* **44**, 319-25 (1927).—G. has described a method for measuring elementary radiation in which the primary ionization effect of the α -particle is intensified by means of electron tubes so that it may be observed galvanometrically and acoustically (*C. A.* **20**, 2116). A special oscillograph is used for the registering of α - and H-rays. The registering impulse of the H-ray is shorter than that of the α -ray. The ratio of the ionizing power of α - and H-rays is approx. $2\frac{1}{2}$. When H_2 is used in the ionizing chamber instead of air, the registering impulse for α -particles is much shorter. J. E. SNYDER

Collision of α -particles with helium atoms. S. GHOSH. *Bull. Calcutta Math. Soc.* **17**, 99-104 (1926); *Science Abstracts* **30A**, 113.—Wilson-cloud photographs of 1203 α -particle tracks in He have been obtained, of which 44 were forked, or 3.65%; this is rather high compared with that observed in H. The range of the recoil atoms varies from 0.94 cm. to 3.2 cm., higher than for H. The angle between the tracks of the recoil atoms and α -particles varies approx from $1^\circ 23'$ to $6^\circ 17'$. Darwin's theory predicts in addition, to small angles of forking angles of about 90° , no such cases were observed. Conclusion. The shape of the He nucleus is oblate spheroidal. None of the recoil-atom tracks was appreciably longer than those of the α -particles from which they originated, this shows that the recoil atoms do not exist as singly charged particles during the whole course of their existence as ionizing agents. H. G.

Fixation of the radioactivity of the air by the terrestrial electric field. EDOUARD SALLES. *Compt. rend.* **185**, 144-5 (1927).—A wire 10 to 15 m. long was stretched on a roof and exposed to the sun. It was rapidly rolled up and placed in an electroscope. The discharge averaged about 10 times as fast as the natural leak. The duration of the activity on the wire indicated Ra A, Ra B and Ra C. L. D. R.

The vaporization of polonium. P. BONET-MAURY. *Compt. rend.* **185**, 204-6 (1927); cf. *C. A.* **21**, 3016. A curve is given showing a comparison of the exptl. and theoretical distribution of Po which has passed through a slit and has condensed on a disk at any given radius. A verification of the law of cosines has been obtained. E. P. WIGHTMAN

Temperature coefficient of γ -ray absorption. L. BASTINGS. *Nature* **119**, 51 (1927).—The coeff. of γ -ray absorption of lead over a range of 250° increases by about 0.2% per 100° rise of temp. (cf. Read, *C. A.* **20**, 2616). B. C. A.

The method of streaming potentials. H. LACHS AND JOSEPH BICZYK. *Physik. Z.* **28**, 556-8 (1927); see *C. A.* **21**, 1747. MARIE FARNSWORTH

Lag in electrical discharges. W. CLARKSON. *Phil. Mag.* [7]. **4**, 121-33 (1927); cf. *C. A.* **21**, 2220.—The variation of the "peak" voltage in the intermittent discharge in discharge-tubes of scrupulous cleanliness is considered, and possible causes, both in the gas and in the electrodes, are sought for and applied in explanation. Exptl. results would agree with a "corona" lag, a theory of which is developed, if a slow "build up" is assumed. This assumption is shown to be justified from results obtained by a method, here described, for measuring the time of duration of a "flash," or condenser discharge. The small preliminary discharges often preceding a "flash" are explained on the same assumption as due to the form of the "corona characteristic." Possible causes of this slow "build up" are discussed, and it is tentatively assoc. with the apparently inevitable modification of the cathode surface by the filling gas. GEORGE GLOCKLER

Three-point spark gap. J. D. MORGAN. *Phil. Mag.* [7]. **4**, 91-100 (1927).—Expts. confirm the conclusion previously established by Wynn-Williams (*C. A.* **20**, 1351) that the action of the auxiliary spark in a three-point gap is due to ionization of the gas in the main gap by radiation given off from the auxiliary spark. They also go further, and show that the Wynn-Williams effect is due to an impulsive or transient condition. Moreover, they show that when a needle-point or an auxiliary spark-gap is connected to a steady source of potential, such as a Wimshurst machine, the action of the needle-point or the auxiliary spark on the main gap is then due not to radiation but to an ionized stream. GEORGE GLOCKLER

Two- and three-electrode systems in hydrogen. B. TREVELYAN. *Phil. Mag.* [7], 4, 64 77(1927); cf. *C. A.* 19, 436.—The current which passes in a discharge is governed by 2 factors, the applied elec. field and the unequal rate of diffusion of the ions; variation in the conditions of the discharge causes one or the other to be predominant. Under conditions which give rise to a large concn. of electrons and small potential gradient due to applied field, the current may be carried chiefly by diffusion. In the two-electrode tube large fields are absent, the main fall of potential occurs between the filament and grid, and the potential of all the luminous region beyond is not far different from that of the grid. There will, therefore, be practically no resultant field along the glow except that due to local concn. and diffusion effects. When there are no striations, the system may be regarded as consisting roughly of 2 equipotential surfaces, the walls and filament forming one, and the grid and the glow the other, practically the whole fall of potential occurring in the dark space between them. By inserting an anode as third electrode, and superposing a field between anode and grid, the system is altered. If the field between grid and filament is not too large, the grid and walls now form an approx. equipotential surface. The former acts as cathode in the main discharge between grid and anode, but here the cathode and anode are far apart and the main luminous region is between them, while in the two-electrode tube the distance between cathode and anode was small compared with the diam. of the tube, and the luminous region was beyond the grid. In one case there is a field along the glow, and in the other the applied field has practically no effect in the luminous part. In the presence of the field, diffusion along the tube is helped, but diffusion toward the walls is hindered. The greatest difference between the two- and three-electrode systems lies in the energy of the electrons. In the former, the electron temps. in the glow are high, and of the order of the ionization potential of H_2 , in the latter, the temps. are much lower. This suggests that in the two-electrode system the luminosity was produced by fast electrons able to ionize the gas directly, but in the three-electrode system by less direct means.

GEORGE GLOCKLER

Corrections for the paper: "The orbits and light emission of hydrogen electrons." T. ENGSET. *Ann. Physik* 83, 903 4(1927).—A table of corrections for a previous paper (*C. A.* 21, 3152).

MARIE FARNSWORTH

The calculation of the mean value in the Lorentz electron theory. V. BURSIA. *Z. Physik* 43, 416-26(1927).—The mean value of current and charge in the electron theory is derived with the use of the Lagrange series development. This deviates somewhat from that of Minkowski-Born and Fokker but leads to the same result in a somewhat simpler manner. The mean value is expressed through quantities like polarization, magnetization, etc., which in general are not plainly definable. The question of the conditions under which the unequivocalness of the mean value can be asserted is considered.

MARIE FARNSWORTH

Heats of condensation of electrons and positive ions on molybdenum in gas discharges. C. C. VAN VOORHIS. *Phys. Rev.* 30, 318-38(1927).—A new calorimetric method for measuring the electronic work function of a metal in a gas discharge has been developed. A small Mo sphere was supported in a region of intense gas ionization by 3 fine wires, 2 of which formed a thermocouple to measure its temp., while a third carried the current of the incoming ions. Space potentials and mean electronic energies E_- were found by using the sphere as a Langmuir collector. Its rate of heating due to an increment Δj in the electron current reaching it against a small retarding field was measured and equated (with small corrections) to $\Delta j(E_- + \phi_-)$, whence the heat of electron condensation ϕ_- was found. The values of ϕ_- found by this method were: 4.76 v. in A, 4.04 or 4.35 v. in H_2 (mixed with A) and 4.77 or 5.01 v. in N. The doublet values follow different treatments of the surface. Because of uncertainties in the sp. heat values of Mo these results may be a few per cent too high; consequently, all the information required to make any necessary corrections from more satisfactory sp. heat values has been given. By a modification of the method, ϕ_+ for an A positive ion neutralized at a Mo cathode was found to be about 1 v. This low value indicates that a large part of the energy of neutralization at the cathode of a discharge is lost by the neutralized mols., probably by radiation, before they make thermal contact with the metal. The presence, in a low-pressure gas discharge, of the high-speed "secondary" electrons is shown by the good agreement between E_- obtained calorimetrically and values calcd. from the $\log j$ —against $-V$ lines of the 2 groups of electrons as obtained by Langmuir's methods.

BERNARD LEWIS

The effect of the medium on gas-ion mobility. H. A. ERIKSON. *Phys. Rev.* 30, 339-48(1927).—Results are given showing the effect on the mobility of adding foreign gases to the air through which the ions move. The conditions were such as to permit

the use, at least initially, of identical air ions. It is shown that adding CO_2 and water vapor to the air diminishes the mobility but adding H_2 increases the mobility. The results also indicate that the change in the mobility is due to the change in the medium and not to a change in the ions. It is found, however, that increasing the relative humidity gives a larger proportion of initial or 1.87 ions, indicating that H_2O simplifies the final positive air ion. It is also shown that a trace of C_2H_2 gives rise to an ion which has a mobility only slightly less than the initial air ion. It is also found that when C_2H_2 remains in air, a body is formed which when it becomes charged has a lower mobility. Results are given showing that adding Cl_2 and C_2H_4 to the air has no effect on the mobility within the time of observation used, whereas a trace of NH_3 results in the formation of a single positive ion of the same mobility as that of the negative ion which is not affected.

BERNARD LEWIS

Radiation produced by the passage of electricity through gases. J. J. THOMSON. *Phil. Mag.* [7], 2, 674-701 (1926); *Science Abstracts* 30A, 129.—An account is given of expts. on the character of the radiation produced when elec. currents pass through gas at a low pressure. The method adopted is to let the radiation fall on a disk of metal and measure the variation in the rate of emission of electrons due to the photoelec. effect when the emission is retarded by an elec. field tending to stop the escape of electrons. The theory of the variation of the rate of emission with the strength of the field is worked out, and methods are given for detg. from the graph representing the relation between rate of emission and the p. d. in the retarding of the spectrum of the radiation. The radiation produced by the passage of cathode and positive rays through the gas, and from the negative and anode glows in H, O, He and A at different pressures are discussed. The frequencies of by far the greater part of the radiation are comparable with those corresponding to quanta of the order of the ionizing and resonance potentials of the gas, in the radiation due to the cathode rays these radiations are mixed with others of higher frequency. In a few cases the radiation is fairly homogeneous, but in general it is a mixt. of radiation having a frequency comparable with that of the ionizing radiation with other radiation of a lower frequency. The electrodeless ring discharge is a very copious and convenient source of radiation of this type. H. G.

Atmospheric ionization and its effect on the propagation of short electric waves. H. LASSEN. *Z. Hochfrequenztechn.* 28, 109-13, 139-47 (1926); *Science Abstracts* 30B, 183-4.—An account is given of our present-day knowledge of the constitution of the upper layers of the atm. and their ionization by ultra-violet light, particularly with reference to the propagation of short elec. waves. It appears, from the data given that a particularly strongly ionized layer exists between the heights of 95 and 130 km. This layer has no sharply defined boundary on the lower side, within the layer the ionization increases at first in the upward direction and then decreases again. The propagation of short waves to great distances takes place principally in this layer, the explanation of the effects being found in the refraction of the waves by the ionized layers. There appears to be little or no appreciable reflection and the damping of the waves is small. The ionized layer persists through the night, but the concn. of the ions varies and explains the difference between the day and night effects. Explanations are also given of such phenomena as the dead zone, fading, etc. H. G.

Ionization phenomena in active nitrogen. P. A. CONSTANTINIDES. *Nature* 119, 163 (1927).—Differences in the ionization effects according to the gases mixed with the N are held to indicate that active N may be due to a metastable state of the N mol. with energy between 9.4 and 10.4 v. (LORD) RAYLEIGH. *Ibid.* 163.—A reply to Constantinides.

B. C. A.

Continuity of existence (of electrons). D. B. MAIR. *Nature* 119, 199 (1927).—The theory of relativity indicates that the existence of electrons is discontinuous.

B. C. A.

Deformation of electronic orbits in crystalline salts. K. FAJANS. *Rozniki Chem.* 6, 396-403 (1926). Examples are given where measurements of the refraction of alk. earth fluorides indicate various degrees of deformation of electronic orbits.

B. C. A.

Law of force between electrons, two electron orbits and models of the helium atom. A. W. CONWAY AND G. KEATING. *Proc. Roy. Irish Acad.* 37, 40-51 (1926); *Science Abstracts* 30A, 163. The failure of the usual application of the quantum principle to the He atom to give series formulas of the correct type or a good agreement with the ionization potential is ascribed to the failure of the inverse-square law under these conditions. The correct spectral and ionization quantities are taken and the law of necessary to fulfill the conditions is investigated.

H. G.

The ionization by electrons in a homogeneous electric field. F. M. PENNING.

Z. Physik **40**, 4-9 (1926).—G. Hertz's calcs. of electronic diffusion (cf. *C. A.* **19**, 2908) and Compton and Van Voorhis' researches on the probability of ionization of gases by electronic impact (cf. *C. A.* **20**, 146, 2946) have been applied to an investigation of the electronic motion in a homogeneous elec. field. The number of impacts, the loss of energy caused by elastic impacts and the ionization per unit of length have been calcd. and the results applied to discharges in Ne. EMIL KLARMANN

Stripped yttrium (Y III) and zirconium (Zr IV). I. S. BOWEN AND R. A. MILLIKAN. *Phys. Rev.* **28**, 923-6 (1926).—The hot spark spectra of Y III and Zr IV have been identified and series relationships and term values are tabulated. In Y and Zr the normal position of the electron is in a 4d orbit rather than in a 5s orbit. B. C. A.

Configuration of a Lorentz electron moving arbitrarily along a straight line. S. C. WANG. *Phys. Rev.* **28**, 1309-14 (1926).—A differential equation is obtained which is invariant under a Lorentz transformation. The exact solution of the equation is obtained. B. C. A.

Value of the potential in the interior of a moving group of electrons. P. BRICOUT. *Compt. rend.* **183**, 1269-71 (1926).—Poisson's equation for the detn. of the distribution of the potential between 2 electrodes is applied to plane electrodes, and to coaxial cylindrical electrodes. It is concluded that in the detn. of the resonance potential of a gas by the method of electronic shock the electrodes should be placed so that the electronic current is sufficiently feeble to maintain a const. potential at different points in the gas. B. C. A.

Atmospheric ionization. J. J. NOLAN AND G. P. DE SACHY. *Proc. Roy. Irish Acad.* **37**, 71-94 (1927); *Science Abstracts* **30A**, 426. —In a previous paper (*C. A.* **20**, 1363) it was shown that about 40% of the atm. nuclei of condensation were uncharged, the remainder being positive and negative large ions carrying unit electronic charges. In this paper the problem of equil. of ionization is examd. without assuming equality of concn. of the 2 signs. The small atm. ions are found to be a mixt. of ions of different mobilities, viz., of the Langevin ions and those similar to the ions produced by the spraying and bubbling of liquids. The equil. concns. are given for different conditions. For the cond. of the lower layer of the atm. at Dublin a rough calcn. based on the data gives $A = 0.45 \times 10^{-4}$ c. s. units. H. G.

Development of the arc discharge. R. SEELIGER. *Physik Z.* **27**, 730-2 (1926); *Science Abstracts* **30A**, 215. —A discussion is given of the differences between and the similarities of the glow and arc discharges in discharge tubes. It is pointed out that the only fundamental difference between the 2 is in the phenomena at the cathode. The development of the arc discharge from the glow discharge is discussed and experimentally investigated in a special discharge tube with the cathode a Hg surface at the end of a small quartz tube, the discharge tube being filled with N or one of the rare gases. (Cf. *C. A.* **20**, 1175.) H. G.

Significance of certain critical potentials of mercury in terms of metastable atoms and radiation. H. A. MESSENGER. *Phys. Rev.* **28**, 962-75 (1926), cf. *C. A.* **21**, 3153. —When the crit. potentials of Hg are examd. by a method distinguishing between effects due to metastable atoms and those due to true radiation, all the breaks found by Franck and Einsporn (*C. A.* **14**, 3360) except those at 5.76, 6.73 and 8.35 v. are shown to be associated with increased production of metastable atoms, and breaks at 6.04, 6.30, 7.12, 7.46 and 8.09 v. are shown to be due mainly to the formation of metastable atoms. Breaks at 6.7 and 8.35 v. are due to radiation of wave length 1849 Å. B. C. A.

The total ionization due to the absorption in air of slow cathode rays. J. F. LEHMANN AND T. H. OSGOOD. *Proc. Roy. Soc. (London)* **A115**, 609-24 (1927), cf. *C. A.* **20**, 2784. —The av. energy expended in the formation of a pair of ions in air was found to be 45 electron-v. F. O. A.

The absorption of slow cathode rays in various gases. J. F. LEHMANN. *Proc. Roy. Soc. (London)* **A115**, 624-39 (1927); cf. preceding abstr. —The av. energy expended in the formation of a pair of ions in electron-v. and the efficiency of ionization are, resp., He 31, 0.78; A 33, 0.46; H 37, 0.43; N 45, 0.38; CO₂ 45, 0.32. In all cases the av. ionization for complete absorption is proportional to the initial energy of the cathode ray. The range of the rays is also estd. from the pressure necessary to absorb the rays within the ionization chamber and from the rate of absorption of electronic energy. The 2 estimates are concordant. F. O. ANDEREGG

The heat of dissociation of O₂ and O₂⁺. R. T. BIRGE. *Phys. Rev.* **27**, 641 (1926). —The heat of disson. of O₂ is 7.05 ± 0.03 v., while the ionization potential of O₂ is 13.54 v., of O₂ is 14.1 v. and, therefore, of O₂⁺ is 6.46 to 6.49 v. F. O. A.

Heat of dissociation of CO, CQ⁺, and NO. R. T. BIRGE AND BERTHA SPONER.

Phys. Rev. **27**, 641(1926).—The heat of disson. from chem. data, 10.78 v., is confirmed by combining the ionization potential of CO with that of O₁ (13.5 v.) and the heat of disson. of CO⁺ calcd. from spectral data (9.82 v.). NO dissociates to form N₁ and an excited O₁ contg. about 8.9 v. as compared with the O resonance potential at 9.1 v.

F. O. A.

The heat of dissociation of N₁ and N₂⁺. BERTHA SPONER. *Phys. Rev.* **27**, 641 (1926).—The final state for the first positive group is set at 11.87 v. Ionization potential of N₁ lies probably closer to 14 than to 13 v.; that of N₂ is 16.5 v. and that of N₂⁺ is about 9.06 v.

F. O. A.

The conductivity of activated nitrogen. P. A. CONSTANTINIDES. *Phys. Rev.* **27**, 249(1926).—The ion current of activated N produced in the electrodeless discharge follows Ohm's law up to the satn. potential. Above this a marked increase occurs near the ionization potential of N₂.

F. O. A.

The combination of nitrogen and hydrogen activated by electrons. A. CARESS AND E. K. RIDEAL. *Proc. Roy. Soc. (London)* **A115**, 684-700(1927).—With the use of thermions the production of NH₃ by the various possible mechanisms has been studied in detail. NH₃ may be formed by N₂ reacting with H₁ at the surface of Pt or Ni or with H⁺ in the bulk at 13 v. N₂⁺ is active in the bulk at 17 v. while N₁⁺ is active at 23 v.

F. O. A.

Surface layers on tungsten produced by active nitrogen. CARL KENTY AND L. A. TURNER. *Nature* **120**, 332(1927).—A clean W surface at a dull red heat when placed in an atm. of N₂ activated by a condensed discharge becomes covered with a layer of N about 1 atom deep. The layer can be flashed off in an active form or deposited on an adjacent clean surface.

C. H. GREENEWALT

The dimension of the atom and the photoelectric effect. E. N. GAPON. *Z. Physik* **44**, 535-6(1927).—From the Einstein photoelectric equation and Bohr's equation for electronic energy, G. obtains the formula $r = 5.808 \times 10^{-12} \lambda_m$, where r is the at. radius and λ_m the wave length of the photoelec. threshold. The results show a rough parallelism with those obtained by Bragg. Since C gives a value double that found by Bragg, it is concluded that the C mol. is diatomic.

F. A. J.

Mean free path of electrons in ionized mercury vapors. K. B. BLODGETT. *Phil. Mag.* [7], **4**, 165-93(1927).—Langmuir's method of investigating the properties of glow discharges by means of auxiliary electrodes is used to det. the mean free path of electrons in ionized Hg vapors. Cf. *C. A.* **19**, 1531.

GEORGE GLOCKLER

Refraction of x-rays. BERGEN DAVIS. *J. Franklin Inst.* **204**, 29-39(1927).—A review.

R. L. HERSHEY

Refraction of x-rays by method of total reflection. R. L. DOAN. *Phil. Mag.* [7], **4**, 100-12(1927), cf. *C. A.* **17**, 2674; **20**, 1351, 2097. —Additional cases are presented in which the Drude-Lorentz theory of dispersion represents the facts, not only in regions remote from an absorption edge, but also in some instances in which the frequency of the radiation approaches the natural frequency of certain groups of electrons. The interesting possibility of studying the distribution of electrons among the lower at. levels has received additional support. The information obtained here is very definite so far as the K-electrons are concerned, but the distribution among the various L-levels is a much more complex problem. However, the detn. made for Au shows that it is not impossible to have some measure of success even here. Of course, it will be necessary to increase the accuracy of the measurements considerably before one can hope to decide between various groupings of L-electrons.

G. GLOCKLER

The Röntgen spectrum of the second kind. M. J. DRUYVESTEYN. *Z. Physik* **43**, 707-25(1927).—The intensity of the Rontgen spectrum of the 2nd kind relative to that of the normal Rontgen spectrum is theoretically discussed and it is shown that the theoretical expressions are supported by the exptl. facts. New measurements are given relative to the lines of the 2nd kind. A part of these lines can be explained theoretically and their position calcd.

MARIE FARNSWORTH

Distribution of directions of the electrons released by polarized Röntgen rays. FRITZ KIRCHNER. *Ann. Physik* **83**, 521-34(1927); cf. *C. A.* **21**, 2604, 3309. —The distribution of directions of the photoelectrons sent out by polarized x-rays is systematically studied; it is shown to be independent of the wave length of the absorbed rays in the range from 0.3 to 0.8 Å. U. and of the work of detaching the photoelectrons in the range from 300 to 3000 v. The found distribution of directions corresponds approx. to a sine square distribution; the hypotheses of Auger and Perrin and the recent one of Wentzel from wave mechanics drawn from theoretical conclusions are in agreement with the expts. For the range law $V_{KV} = \text{const. } \sqrt{R}$, where V_{KV} denotes

the initial energy of the electrons in kv., the const. for A has a value of 22.6 at 760 mm. and 0°.

MARIE FARNSWORTH

Röntgen studies of inorganic colloids. J. BÖHM. *Kolloid Z.* **42**, 276-84 (1927).—By using the Debye-Scherrer method and Fe_2O_3 , it is found that crystals > 0.1 mm. give large spots on the film, around 0.1 mm. small spots, 0.01–0.001 mm. sharp lines, colloidal dimensions broad lines, and amorphous material no lines. With hematite fiber diagrams are obtained. An analogous series is given for stannic acid gel except that here there were no particles large enough to give spots. Photographs of Au, Pt and Ag sponge are also given.

MARIE FARNSWORTH

A Röntgen apparatus for crystallographic studies in chemical laboratories. J. BÖHM. *Kolloid Z.* **42**, 285-7 (1927).—A simple set-up consisting of a source of high potential, an x-ray tube (Philips model), and a camera for line or Laue photographs is described.

MARIE FARNSWORTH

An experimental study of the relative intensities of x-ray lines in the L-spectrum of thorium. S. K. ALLISON. *Phys. Rev.* **30**, 245-54 (1927).—The relative intensities of the Th L-series lines have been measured at 31.8 kv., an ionization chamber spectrometer being used. In addn. to the lines previously reported by other investigators, the lines Th L_{γ_1} , Th L_{β_7} , Th L_{γ_2} were found. No indications of the Th L_{γ_3} or Th L_{γ_4} could be found. The relative intensities have been corrected for absorption in the mica windows and air in the path from x-ray tube to ionization chamber, and for the fraction of the radiation absorbed in Mel in the ionization chamber. In the voltage range between the crit. excitation voltage, V_0 , and 31.8 kv., the intensity of the Th L_{α_1} or Th $L_{\beta_{1,10}}$ at any voltage, V , could be expressed by $I = k(V - V_0)^2$ within the limits of explt. error. With this expression the relative intensities at 31.8 kv. were extrapolated to the relative intensities at high voltage to which it was assumed the theoretical predictions apply. The intensity rule for doublets holds for lines involving the levels L_{21} and L_{22} . The predictions of Wentzel (cf. *C. A.* **20**, 3130) based on Schrödinger's new quantum mechanics for the relative intensities of "sharp" and "diffuse" series doublets are confirmed but the explt. intensities of the "principal" series doublets are too low by a factor of 7. They are also too low in the measurements of Jönsson (cf. *C. A.* **20**, 2280) on W. The results obtained are as follows:

Line	l	α_2	α_1	η	β_4	β_2	β_1
Relative Intensity 32 kv.	36	12	100	1.1	1.4	26	0 45
Relative Intensity high voltage	36	12	100	1.8	1.4	26	0 45

Line	β_1	β_3	γ_5	γ_1	γ_2	$\gamma_3 + \gamma_6$	γ_4
Relative Intensity 32 kv.	38	1 8	0	8 5	0.81	3.1	0
Relative Intensity high voltage	62	3.3	0	14	1.5	5.3	0

BERNARD LEWIS

X-ray diffraction in liquids: primary normal alcohols. G. W. STEWART AND R. M. MORROW. *Phys. Rev.* **30**, 232-44 (1927).—Concerning x-ray diffraction in liquids, the viewpoint is taken that there is a mol. space array, not cryst., which is named *cybotaxis*. Evidence of the cybotactic state in the liquid primary normal alcs., methyl to lauryl, is adduced. By Mo $K\alpha$ x-ray diffraction ionization curves, 2 significant distances are measured, the first linearly dependent upon the content of C atoms and the second practically independent of this change in mol. length. The latter is thus the distance of sepn. perpendicular to the chain, and is 4.6 A. U. with lauryl, decreasing slowly to 4.4 A. U. with butyl and then rapidly to 3.8 A. U. with methyl. The value 4.6 A. U. is in agreement with the work of Adam (cf. *C. A.* **16**, 4, 4107; **17**, 3436), on surface films of satd. fatty acids. The increase on the first distance linearly with C content is in harmony with the work of Müller and Saville (cf. *C. A.* **19**, 1692) in that the increase is about 1.3 A. U. per C atom and leads to the conclusion that the diffraction is produced by planes contg. the polar groups which are not perpendicular to the direction of the parallel chain mols. Comparison of peaks in the liquid and solid states shows that the spacings are not the same and the phenomena are not caused by crystal fragments. The cybotactic state permits mobility but not random motion and is peculiar to the substance. The distances computed are the most probable spacings. The mols. may be regarded as having the same orientation in a small group too small to give optical anisotropy. The discussion does not therefore extend to liquid crystals but adheres to the more general condition. The conception of cybotactic state is helpful in an understanding of solns. and other liquid phenomena.

BERNARD LEWIS

Satellites of lines of x-rays. D. COSTER AND M. J. PRUYVESTEYN. *Z. Physik* **40**, 765-74(1927).—A new x-ray tube is described for fluorescence observations, with which satellites could be observed on the hard side of the lines, although the intensity was less than that obtained by cathode-ray excitation. The existence of these satellites indicates the simultaneous ejection of 2 electrons from the inner ring of the atom. The satellites on the soft side of the lines possessed normal intensity. Their interpretation is discussed. B. C. A.

Theory of the continuous x-ray spectrum. M. NEUNHÖFFER. *Ann. Physik* **81**, 493-522(1926); *Science Abstracts* **30A**, 140.—An attempt to calc. the energy distribution in the continuous x-ray spectrum, taking into account the possible hyperbolic paths of the electrons in the vicinity of the nuclei of the bombarded atoms. The degree of polarization is also discussed. The exptl. data are in moderate agreement with the theory, but several difficulties arise. H. G.

Energy transformations in certain x-ray effects. R. GLOCKER. *Z. Physik* **40**, 479-91(1926). *Science Abstracts* **30A**, 401.—A general discussion is given of the relation between the incident x-ray intensity and the consequent ionization current in the gas of the ionization chamber. It is emphasized that in the neighborhood of an absorption edge of the absorbing gas the ionization current i is independent of wave length, and is related to the incident intensity I_0 by the formula. $i/(\gamma I_0) = \text{const.}$, where γ is not the total absorbed energy but the fraction of the incident x-radiation transformed into kinetic energy of secondary electrons. A similar type of formula holds for the photographic action of x-rays. A reconsideration of Sadler's measurements of the percentage of excited atoms which emit fluorescence radiation indicates that this quantity decreases somewhat as the difference of frequency between incident and characteristic radiation increases. H. G.

• **The temperature curve of the anode of an x-ray tube.** A. BOUWERS. *Z. tech. Physik* **8**, 271-7(1927).—On account of evapn. 3000° is the maximal allowable temp. for a W x-ray anode mirror; the max temp. for the Cu in back of the W is limited to 1080°. These temps. depend on heat cond. k of W and Cu, and on their sp. heat c , on the duration of the load and the thickness of the mirror, values of $k_w = 0.45$, $k_{Cu} = 0.9$, $c_w = 0.7$ and $c_{Cu} = 1.0$ have been assumed. For a linear focal spot (3 mm. wide) of great length Seeligers soln. for temp. distribution (*Physik. Z.* **27**, 35(1926)) perpendicular to the focal line is valid. Calcd. curves are given for Cu and for Cu + a 1.7-mm. W layer. For the W surface temp. is found 2650°, at the W-Cu border line 1050° for 1-sec. exposure at 20 kw. per sq. cm. For very short exposures the Cu can be neglected and the temp. is found to be $T = 4800 \sqrt{t}$ ($t < 0.07$). T runs up with the time t , approaching a limit. T is proportional to the kw. load and the W thickness is on one side limited by the low m. p. of Cu, on the other side by the better heat cond. of Cu. The most favorable W thickness increases with exposure time. Other curves give allowable total load in millamp. sec. and in millamps, both as a function of time. Tubes with pulsating d. c. or a. c. can only be loaded to half the value of pure d. c. tubes. On a Philips Metalix tube the results were verified by taking an actual millamp. sec. versus time curve for a temp. of 1300° with 50 kv. potential. Because of slight pulsation of the current the values for the shortest exposure times are a little below the theory. From a calcd. temp. in the focal plane and practical results it was found that the temp. drop at both edges of the focal strip is very steep (1800° down to 1400° in 0.2 mm.; brightness down to 1%). B. J. C. v D. H.

Energy measurements for Röntgen rays. WALTHER RUMP. *Z. Physik* **43**, 254-95(1927).—A calorimeter has been described which detcs. the thermic effect of x-rays. It measures the total incoming radiation and the back radiation in abs. units. With this calorimeter, the relation between the x-radiation energy and the voltage of its source has been measured, the range was 43-150 kv. It seems to be established that the total energy increases with the square of the voltage. The total energy of the Röntgen radiation has been compared with the cathodic energy of the Röntgen tube, and the efficiency with which x-rays are generated has been calcd. In the range 43-150 kv., this efficiency is 0.5-1.6%, which is considerably higher than what has been assumed so far. From calorimetric energy measurements and ionization measurements, the amt. of energy has been detcd. which is necessary to create a pair of ions in air; x-rays of various qualities have been used; the required energy amts. to 40 v. per pair of ions in the case of a strongly filtered hard radiation, and is fairly const. for an electronic velocity of 28-107 kv., or for x-ray wave lengths averaging 0.43-0.12 Å. U. A. L. HENNE

Correction to the paper: "Energy measurements for Röntgen rays." WALTHER

RUMP. *Ibid* 44, 396.—Further exptl. work shows that the value 40% per pair of ions is too high. The true value, in the range studied, is only 33, which is in good agreement with the value 35 previously found by Kulenkampff (*C. A.* 20, 2943).

A. L. HENNE

The extinction of the fluorescence in solid and liquid solutions of dyes. V. L. LEVSHIN. *Z. Physik* 43, 230-53(1927).—A discussion of the various theories of the phenomenon, and of the methods of measurement and calcn. serves as an introduction. In solid solns. the extinction of the fluorescence of dyes behaves substantially the same as in liquid solns.; an increase of the concn. of the dye modifies the fluorescence spectrum. In aq. solns. of fluorescein, the fluorescence spectrum is independent of the concn.; the shape of the absorption curves is slightly modified in the region of the extinction of the fluorescence. In the case of a high concn. of the dye, an increase of the temp. increases the fluorescence output; it displaces and modifies the fluorescence spectrum; the absorption spectrum undergoes the same change.

A. L. HENNE

The atomic character of certain properties of x-rays. E. DELAUNAY. *Compt. rend* 185, 193-5(1927).—The fluorescent x-radiation of one element from a mixt. of adjacent elements is not proportional to the concn. of that element in the mixt. Mixts. of SrCl_2 and BaCl_2 were irradiated and the fluorescent radiation was measured by an ionization method. The intensity increased less rapidly than the concn. of BaCl_2 . The intensities of the fluorescent radiation from two elements in such a mixt. are given by the relations. $I_1 = I_0 p_1 \{n_1/(a_1 n_1 + a_2 n_2)\} [1 - e^{-(a_1 n_1 + a_2 n_2)l}]$ and $I_2 = I_0 p_2 \{n_2/(b_1 n_1 + b_2 n_2)\} [1 - e^{-(b_1 n_1 + b_2 n_2)l}]$, where I_0 is the intensity of the monochromatic primary beam; p_1 and p_2 are the emissive powers of the two elements; n_1 and n_2 their concns., and a_1, a_2, b_1 , and b_2 are given by $a_1 = v_1 - v_1', a_2 = v_2 - v_2', b_1 = v_1 - v_1'', b_2 = v_2 - v_2''$, where v_1 and v_2 are the absorption coeffs. of the two elements for the primary radiation, and v_1', v_2' and v_1'', v_2'' are the coeffs. for the fluorescent radiation.

R. L. HERSHEY

Emission of soft x-rays by different elements. O. W. RICHARDSON AND F. S. ROBERTSON. *Proc. Roy. Soc. (London)* A115, 280-90(1927).—The efficiency of emission of x-rays at voltages up to 500 v. were detd. for 14 elements. A special app., using a filament for supplying electrons, and a Ni plate and electrometer for measuring the x-ray intensity, and allowing six specimens to be examd. consecutively without disturbing the conditions, was used. Plots of the photoelec.-thermionic current ratio against λ show the ratio to be a periodic function of λ , increasing with increasing voltage almost proportionally.

R. L. HERSHEY

Diffraction of x-rays in liquids. G. W. STEWART, R. M. MORROW AND E. W. SKINNER. *Phys. Rev.* 27, 104(1926).—The diffraction of the Mo $K\alpha$ line by liquids was detd. by an ionization method. Solid and liquid camphor at 21° and 205°, resp., show the same location of intensity peaks, allowance being made for expansion. Naphthalene, α - and β -naphthol, when liquid, show single broad peaks, which are roughly the means of the peaks of the solid substances. These single peaks occur at temps. near the f. p.; the cryst. peaks persist to the m. p. In methyl, propyl, hexyl, octyl and decyl alcs. a single broad peak is accompanied by a smaller one, indicating a larger spacing. The intensity curves shift to smaller values of θ with heavier mols. The data are interpreted as showing crystal fragments, i. e., diffraction due to interatomic causes.

R. L. HERSHEY

A universal x-ray photogoniometer. J. D. BERNAL. *J. Sci. Instruments* 4, 273-84(1927).—B. discusses crystal lattices and planes, the diffraction of x-rays by them, the exptl. data of x-ray crystallography, the various x-ray methods with their advantages and disadvantages, and the essentials of a universal photogoniometer. The theory of the rotation method, as applied to single crystals, the reciprocal lattice and the detn. of unit cell size by the rotation method are treated in more detail.

R. L. HERSHEY

A refinement of the Debye-Scherrer method of investigating crystal structure. G. KURDJUMOV. *Z. Physik* 43, 921-33(1927).—The influence of slit height, width and position and thickness of sample upon the line breadth in the Debye-Scherrer method is treated mathematically. The width of the second opening (farthest from the sample) has no effect on line breadth. The width of the first opening can be calcd. from $\delta_1 = R(2b/a)$, where R is the camera radius, $2b$ the slit width and a the slit-object distance. Formulas for slit heights are given. Two slits, perpendicular to each other, rather than the usual round holes, give very sharp lines.

R. L. H.

X-ray diffraction patterns from liquids and colloidal gels. G. L. CLARK, R. H. ABORN, E. W. BRUGMANN AND R. L. DAVIDSON. *Proc. Natl. Acad. Sci.* 13, 549-52

(1927).—For unstretched latex films the spacings calcd. by the Ehrenfest formula ($a = 7.72\lambda/4\pi \sin \theta$, where 2θ is the diffraction angle) from the 2 principal rings were 6.03 A. U. and 14.76 A. U. When, however, the rubber was very carefully purified by a process of fractional soln. and evacuation to const. wt. the spacings were 5.97 A. U. and 11.15 A. U. Intermediate values up to 14.76 A. U. were observed with solvent swelling. With nitrocellulose the following spacings were obtained, the Bragg formula being used:

	Fresh	Aged (light)	Aged (heat)
Untreated dry	{ 7.18 A. U. 4.02	{ 7.17 A. U. 4.05	{ 6.98 A. U. 3.92
Dry, residual solvent present	{ 9.30 4.47	{ 9.32 4.47	{ 7.86 4.31
Oil softener added	{ 7.34 4.31	{ 4.39	{ 4.39

The following results, expressed as % change related to the spacings of the raw liquid oil calcd. by the Bragg formula, were obtained with China wood oil:

	● Inner ring	Outer ring
Raw liquid	8.5 A. U.	4.4 A. U.
Raw dry film (oxidized at room temp.)		+ 1%
Raw gel (polymerized by heat)	+ 3	+ 2
Prepd. liquid	+12	+16
Prepd. dry film	+13	+ 6

X-ray diffraction patterns from liquids and colloidal gels. G. L. CLARK. *Nature* 120, 119-20(1927).—Cf. preceding abstr.

Laue photograph taken with a long slit. U. YOSHIDA AND K. TANAKA. *Nature* 118, 912-3(1926).—Divergent x-rays starting from the focus on the molybdenum target of a Coolidge tube are passed through a long narrow slit, and then illuminate a long thin crystal. The Laue spots thus become an assemblage of lines, each point on any one of which corresponds with a certain part of the specimen. Such correspondence may be observed by the shadows cast by thin lead wires across the slit very near to the specimen. The orientation of the atomic plane of the crystal which causes a diffraction line, and the glancing angle of the beam of x-rays to the atomic plane can then be calcd. at each corresponding point on the specimen, and the indices of an atomic plane responsible for a diffraction line can readily be found. Measurements with single-crystal Al wires are recorded; the angles between the axis of the wire and the 3 edges of the elementary cubic lattice of the crystal are nearly the same for six specimens, and one of the (100) planes of the crystal is situated nearly parallel to the axis of the wire. B. C. A.

Slip in crystals in rolling. S. KONOBEYEVSKII. *Z. Physik* 43, 741-9(1927).—By a study of Röntgen pictures of rolled Al plate, it is established that depending on the degree of working 2 textures can result. The first is formed on account of the slip in the crystals along the rhombic dodecahedron surface, the 2nd along the cubic surface. The slip must run along the plane (110) to the 211 axis. M. F.

Atomic structure of AuSn. G. D. PRESTON AND E. A. OWEN. *Phil. Mag.* [7], 4, 133-47(1927).—The at. structure of the intermetallic compd. AuSn has been examd. by the powder and the Laue methods, the result of the powder method being confirmed by the rotating-crystal method. The analysis shows that AuSn crystallizes on a hexagonal lattice of side 4.307 A. U. and axial ratio 1.276, the d. requiring 2 mols. of AuSn to be assocd. with this unit. The space group is D_{3h}^4 , C_{6v}^4 , or D_{6h}^4 , and the intensities of the reflections agree with a structure in which Au atoms are situated at the points (000) and $(00\frac{1}{2})$ and Sn atoms at the points $(\frac{1}{3}\frac{2}{3}\frac{1}{4})$ and $(\frac{2}{3}\frac{1}{3}\frac{3}{4})$.

GEORGE GLOCKLER

The connection of the specific ray intensity with the ray density. W. ALEXANDROW. *Physik. Z.* 28, 555(1927).—Mathematical.

MARIE FARNSWORTH

Explanation of spectra of Group II. P. K. KICHLU AND M. SAHA. *Phil. Mag.* [7], 4, 193-207(1927); cf. *C. A.* 21, 3022.

GEORGE GLOCKLER

Note on the spectrum of neon. M. SAHA. *Phil. Mag.* [7], 4, 223-31(1927).—Cf. preceding abstract. GEORGE GLOCKLER

Origin of terms of the spectrum of cobalt. N. K. SUR. *Phil. Mag.* [7], 4, 36-49 (1927).—A table is given of electron arrangement of the elements suitable for spectroscopic analysis. There is a discussion of term-values of Co spectrum. G. G.

Geissler discharge in argon. K. G. EMELÉUS AND N. L. HARRIS. *Phil. Mag.* [7], 4, 49-64(1927); cf. *C. A.* 21, 2221.—The Geissler discharge between cold electrodes in A has been studied by means of a cold exploring electrode. The main results, which are probably of general validity for similar discharges in wide tubes at low potential and with small c. ds. are: The electron concn. and random positive ion current attain a max. in the middle of the negative glow. The current is carried from the negative glow through the Faraday dark space by slow electrons moving in combined elec. and diffusion fields. The av. energy of the electrons is very approx. const. in this part of the discharge. The elec. field is reversed between the cathode dark space and the middle of the negative glow, and primary electrons are probably present. The greatest sources of uncertainty are: the estn. of the concn. of positive ions, and the detection of primary electrons, which depends on the analysis of the positive ion currents. It is anticipated that further expts. will make it possible to find the velocity distribution of the primary electrons. GEORGE GLOCKLER

A possibility of the experimental determination of the red shift of resonance radiation by repeated re-emission. S. I. VAVILOV. *Z. Physik* 44, 537-8(1927).—The shift of the resonance line toward longer wave lengths on repeated scattering found in the spectra of giant stars and explained by Franck (*C. A.* 21, 1931) on the basis of the Compton effect might be detected in the lab. by means of the phosphorescope (*C. A.* 20, 3132). The light which has been scattered more often will emerge from the vapor later, and its greater shift could be detd. by the absorption method.

F. A. JENKINS

The electric emission of incandescent platinum in an atmosphere of iodine. PIERRE JEZ. *J. phys. radium* 8, 245-53(1927).—The phenomenon is in agreement with the formula of Richardson. The negative emission in an atm. of I_2 increases considerably with relation to the emission in air under the same conditions. The positive emission in an atm. of I_2 is nearly nil. L. D. R.

Quantitative investigations on the absorption lines of the sun's spectrum. H. VON KLÜBER. *Z. Physik* 44, 481-516(1927).—The theory and exptl. methods of detg. the absorption in the lines of the solar spectrum are described. Preliminary results are given for some lines in the red of Ca, Na, Fe and H α . C. C. K.

The quantitative sensitivity of spectral lines. TR. NEGRESO. *Compt. rend.* 185, 453-5(1927).—A study of the spectra of a series of binary alloys in which one of the elements diminishes progressively in amt. has shown that there is an accompanying diminution in intensity of the lines of that element. For different modes of excitation it was observed that diminution of intensity with amt. was not of the same type as that which occurs when the energy of the source is varied. C. C. KIESS

The rotation spectra of the hydrogen halides. M. CZERNY. *Z. Physik* 44, 235-55 (1927).—The infra-red absorption spectra of HCl, HBr, HI and HF were measured in the region 40μ to 140μ . The spectra, resulting from rotation of the mols., all have the same structure and consist of bands whose wave nos. are represented closely by formulas of the quantum theory. From the consts. of these formulas values are calcd. for the moments of inertia of the mols. The internuclear distances expressed in units of 10^{-8} cm. are: HF 0.923, HCl 1.282, HBr 1.420, HI 1.616. C. C. KIESS

The L absorption discontinuities of silver. GUNNAR KELLSTRÖM. *Z. Physik* 44, 269-78(1927).—The absorption, by means of a suitable thickness of Ag foil, of the strongest L-lines of Ag, Zn and Sb, was measured and the data thus acquired were used to calc. the L absorption discontinuities of Ag. The coeff. μ which measures the diminution in intensity of the rays is in part dependent on the absorption coeff. $\tau = A\lambda^e$ of the absorbing medium. The value of A changes abruptly in going from one side of an absorption limit to the other. The absorption discontinuities are defined as the ratios $\delta_{K_1} = AK/A_{L_1}$, $\delta_{L_1} = A_{L_2}/A_{L_1}$, etc. From the observations the following values were found: $\delta_{L_1} = 3.17$, $\delta_{L_2} = 1.47$, $\delta_{L_3} = 1.25$. C. C. KIESS

Nuclear vibrations in the band spectrum of helium. W. WEIZEL AND CHR. FUCHTBAUER. *Z. Physik* 44, 431-54(1927).—New bands originating in the mol. He $_2$ have been photographed. These have been arranged into systems comprising P, Q and R branches. The bands of He $_2$ already known and the new ones form series systems analogous to those characteristic of the He atom. They are therefore described in the terminology of the at. series as principal, first subordinate and second subordinate

series of orthohelium,* and principal series of parahelium. *The new bands originate in the vibrational changes of the nuclei and correspond to the transitions $0 \rightarrow 1$ and $1 \rightarrow 1$. The details of the analysis including the values of the combining terms are tabulated. C. C. KIESS

The Doppler effect in hydrogen canal rays and the Balmer series. W. STREUBING. *Ann. Physik* **83**, 822-34 (1927).—New observations have been made of the Doppler effect in the canal rays of H, which consisted in measuring the relative intensities of the undisplaced or "rest" line and the displaced or Doppler line. H contg admixts. of He, Ne or Hg gives the same effect as H alone. Similar effects were observed when satd. hydrocarbons were added to the H. With O and N, however, marked changes were noted: the intensity of the Doppler line is much less than that of the "rest" line, the contrast increasing in going from H β to H γ . At H β the "rest" line is less intense than the Doppler line, but at H γ and the succeeding Balmer lines the reverse is true. C. C. KIESS

The "forbidden" line of mercury at $\lambda 2270$ in absorption. (LORD) RAYLEIGH. *Nature* **120**, 295 (1927).—The Hg line at 2270 A. U., forbidden by the selection principle for inner quantum nos., was observed in absorption through a column of Hg vapor 45 cm. long, the Hg boiling at a pressure of 95 cm. This is about 1,000,000 times the vapor density required to show the resonance line 2537 A. U. with comparable intensity. C. C. KIESS

The spectrum of gold chloride. W. F. C. FERGUSON. *Nature* **120**, 298 (1927).—The vapor of AuCl₃ in active N emits in the green a band system, of which the stronger heads are assigned to AuCl³⁶ and the weaker ones assoc'd with them to AuCl⁴⁷. The bands are shaded toward the red. No others beside these were observed in the interval 7000 to 2000 A. U. C. C. KIESS

The propagation of light and the structure of molecules. R. DE MALLEMANN. *Rev. gén. sci.* **38**, 453-79 (1927).—A résumé of the present state of the mol. theory of classical optical phenomena, and an attempt to establish a precise correlation between several apparently irreconcilable phenomena and so to predict some new numerical relations which expt. has verified. E. P. WIGHTMAN

The real and apparent widths of spectral lines. H. C. BURGER AND P. H. VAN CITTERT. *Z. Physik* **44**, 58-69 (1927).—Formulas are developed for finding the real width of a spectrum line from its apparent width as observed with a Fabry-Perot interferometer. The red line of Cd, 6438 A. U., was thus measured and was found to have a true width of 0.0114 A. U. and an apparent width of 0.0176 A. U., which satisfy the formulas derived. The true width is ascribed wholly to a Doppler effect. C. C. KIESS

The spark spectrum of neon (Ne II). I. T. L. DE BRUIN. *Z. Physik* **44**, 157-60 (1927); *Verslag Akad. Wetenschappen Amsterdam* **36**, 502-13. —The term scheme of the quartet system of Ne II, similar to that of F I, has been established and is in agreement with that required by Hund's theory. The lowest term is ⁴P characterized by the sepns. 299.0 and 518.0. Tables contain some of the multiplets which have been found and also the relative values of the combining terms. C. C. KIESS

Influence of the form of discharge on the distribution of energy in the continuous Röntgen spectrum. D. NASLEDOW AND T. KAČURA. *Z. Physik* **44**, 216-22 (1927).—The spectrum emitted by an x-ray tube varied in distribution of intensity according to the manner in which it was excited. Three types of exciting app. were used: (1) "Stabilivolt," (2) "Hartstrahl" and (3) a combination made up of parts by different makers. Ionization chamber measurements showed that the intensity by method (2) is 1.53 times smaller than that by method (1); and the wave length corresponding to max. energy in the continuous spectrum is by method (2) longer than by (1) and (3). C. C. KIESS

The spectrum of argon in the extreme ultra-violet. F. A. SAUNDERS. *Proc. Nat. Acad. Sci.* **13**, 596-600 (1927).—Lines measured in the extreme ultra-violet portion of the spectrum emitted by a discharge in A but not previously included in the spectrum of A I (C. A. **20**, 3641) are now given together with the series designations of Meissner. These lines do not vary in intensity proportionately with the resonance lines of A when the excitation conditions are varied, and were therefore regarded as due to an impurity. C. C. KIESS

Spark spectra of cesium. G. BALASSE. *J. phys. radium* **8**, 311-20 (1927).—Electrodeless discharges in Cs vapor excited continuous and line spectra. The continuous spectrum increased and decreased in intensity with the arc spectrum for moderate discharges and at temps. in excess of 200°. Among the arc lines were members of the series *ls-md*. Extensive tables give wave lengths and wave nos. in vacuum

of lines measured in the various orders of spark spectra excited with increasing strength of the discharge, and include the spectral region from 6700 A. U. in the red to 2300 A. U. in the ultra-violet. C. C. KIESS

Absorption and emission spectra of nitric oxide in the ultra-violet. MAURICE LAMBREY. *Compt. rend.* **185**, 382 (1927).—In the ultra-violet NO was observed to have a series of complex absorption bands, the heads of which are double. They lie at wave lengths 2267 and 2261 A. U., 2153 and 2147 A. U., 2046 and 2041 A. U., 1952 and 1948 A. U. When NO is excited by a condensed electrodeless discharge the first 2 pairs of absorption bands and many additional ones of longer wave length appear as emission bands. The absorption doublets have fine structures, the wave lengths of which were measured. C. C. KIESS

The quenching of mercury resonance radiation by foreign gases. P. D. FOOTE. *Phys. Rev.* **30**, 288-99 (1927).—The intensity of emitted resonance radiation in Hg vapor is decreased as the pressure of an admixed gas increases. The following cycle of transitions occurs for the rare gases or N. Absorption of λ 2537 produces 3P_1 Hg' atoms. Some of these return to the $1S_0$ state by radiating and a portion of this radiation escapes to be observed as resonance. The rest is reabsorbed in the vapor, producing more 3P_1 atoms. Some of the 3P_1 atoms undergo collision of the second type with foreign gas mols. resulting in 3P_0 atoms. A large fraction of these atoms returns to the 3P_1 state by collision of the first type with high-speed gas mols. At 18° one collision in 6000 satisfies the condition of conservation of energy and momentum requisite to such an energy transfer. Other 3P_0 atoms return to the normal state through collision with traces of H_2 impurities in which the energy of the Hg atom is utilized in the dissociation of H_2 . Still other 3P_0 atoms collide with normal Hg atoms producing Hg₂-excited mols. The cycle of transitions is completely developed from kinetic-theory considerations in which every collision, except in the mol. formation, is considered as effective. All the consts. may be computed directly. Cons. of the 3P_0 state as high as one part in a few hundred may be readily obtained under moderately intense illumination. BERNARD LEWIS

Depolarization of resonance radiation. P. D. FOOTE. *Phys. Rev.* **30**, 300-4 (1927).—Depolarization and quenching of Hg resonance radiation are phenomena of quite different type. Depolarization is produced by 2 effects. With gases which quench by effecting the transition $^3P_1 \rightarrow ^3P_0$ upon collision with Hg' atoms, there exists a pronounced reverse transition $^3P_0 \rightarrow ^3P_1$ produced by collision with high-speed mols. Atoms which radiate without any collision emit polarized light under the conditions of the expt. Those which become 3P_1 atoms after having existed as 3P_0 atoms have experienced a large no. of collisions and have lost their orientation relative to the incident elec. vector; accordingly they emit radiation polarized in random directions. The second depolarizing influence arises in collisions at distances exceeding the ordinary kinetic-theory collision such as is described above, at which the distance is too great for a collision of the first or second type but still small enough for the field of the gas atom to exert a perturbing influence on the orientation of the Hg' atom. Depolarization by H_2 is an excellent example of the second influence, while the first effect is sufficient to interpret the exptl. data with rare gases, the at. fields of which decrease with a high power of the radial distance. B. L.

The intensity ratio of the blue cesium doublet. C. F. HAGENOW and A. LL. HUGHES. *Phys. Rev.* **30**, 284-7 (1927).—The rule of Burger and Dorgelo (cf. *C. A.* **18**, 2467) leads one to expect a ratio of 2:1 for the intensities of the members of the blue doublet of Cs (4555, 4593 A. U.), a ratio which is in agreement with some exptl. detns. and in disagreement with others. The method of measuring intensities of spectral lines developed by Merton (cf. *C. A.* **21**, 1061) was employed in this investigation. The results gave ratios ranging from 2.3:1 to 3.8:1, the higher ratios being obtained with more attenuated sources where one would expect from Burger and Dorgelo's rule an asymptotic approach to the 2:1 ratio. As a check on the method the 2:1 ratio generally accepted for the K doublet (4044, 4047 A. U.) was verified. BERNARD LEWIS

Doublet separation and fine structure of the Balmer lines of hydrogen. N. A. KENT, L. B. TAYLOR and HAZEL PEARSON. *Phys. Rev.* **30**, 266-83 (1927).—Using 2 optical trains, (1) 2 crossed Lummer plates, the larger of resolving power of about 670,000, and (2) an echelon of resolving power of about 660,000, the writers have detd. the wave-length difference between the 2 well-known components λ' and λ'' ($\lambda' > \lambda''$) of H_α , H_β and H_γ as 0.1370, 0.0791 and 0.0666 A. U., resp. These values are in good agreement with those obtained by Houston (cf. *C. A.* **20**, 3642) with an interferometer. Further microphotometer curves of enlargements of the original

Lummer plate negatives reveal another component in λ' unresolved but unquestionably present in H_{α} , H_{β} and H_{γ} . Hansen (cf. *C. A.* 20, 1177) noticed asymmetries here in H_{α} and H_{β} . There are also indications of other components in λ' . The magnitudes of these components agree well with the theoretical magnitudes given by the new quantum mechanics with the spinning electron.

BERNARD LEWIS

The spark spectrum of nickel (NiII). A. G. SHENSTONE. *Phys. Rev.* 30, 255-65 (1927).—The analysis of the spark spectrum of Ni shows that the important at. structures are d^8s and d^8p . The low set of terms comprises $^4F^1$, $^2F^1$, $^4P^1$, $^2P^1$, 2D , 2G , of which $^4F^1$ is lowest. The only expected term from the structure d^8s which has not been found is 3S . All the intermediate terms (d^8p) have been found with the exception of a 2P and a doubtful 2F and $^2S^1$. A higher member of the $^4F^1$ $^2F^1$ series (d^8, s) has been found and indicates an I. P. of 17.4 v from d^8s to d^8 . The expected lowest term 2D (d^9) has not been found. Terms are inverted with the following exceptions: (1) a^4G^8 is higher than a^4G^8 , (2) a^4P^3 is higher than a^4P^1 , (3) b^4D^4 is higher than b^4D^1 , (4) triad b^4P , D^1 , F is not inverted. Zeeman effects give some irregular g -values, but the g -sum rule is apparently satisfied. The g -sum rule is not confined to terms built on the same ion term.

BERNARD LEWIS

Photographic spectrophotometry in the ultra-violet. L. A. JONES. *Bull. Nat. Research Council*, No. 61(1926).—The characteristics of photographic materials which must be considered when used for the precise measurement of radiation intensities are discussed. Such factors as the intermittency effect, failure of the reciprocity law, variation of gamma with wave length, non-uniformity of effective sensitivity, and non-uniformity of development may cause serious errors unless the method adopted and the technic followed are specifically designed to eliminate these errors. The criterion of equality between 2 radiation intensities is that equal densities shall be produced by equal exposure times, it being assumed that the radiations in question are of the same wave length or of identical wave-length compn. and that exposure is non-intermittent. A method is described which meets the theoretical requirements. The instrument required for the application of this method is also described. The application of photographic spectrophotometry to the measurement of solar radiation in the ultra-violet region is discussed and some suggestions are made for the development of a method free from objectionable features.

L. A. JONES

Deviation from Lambert's law and polarization of light emitted by incandescent tungsten, tantalum, and molybdenum, and changes in the optical constants of tungsten with temperature. A. G. WORTHING. *J. Optical Soc. Am.* 13, 635-49(1926).—The deviations from Lambert's cosine law for the light emitted by W, Mo and Ta are of the same order. The brightness increases from the normal value at normal emergence gradually with increase in emergence angle to about 75° by 20%, and then decreases rapidly to 0 at grazing emergence. Straight filaments of circular cross-section have av. brightnesses, viewed normal to their axes, which are greater than the normal brightness by 2.8% for W, 3.6% for Mo, 2.7% for Ta. The av. brightness of a filament considering all directions is about 5% greater than the normal brightness. The polarization of the light emitted, which is zero for normal emergence, increases with angle of emergence to about 95% at grazing emergence, and, for straight circular filaments viewed normal to their axes, is about 20%. The values of the optical consts. n and k for W were 3.86 and 0.81 at 300° abs. and 3.85 and 0.89 at 1900° abs.

B. C. A.

Stark-Lunelund effect. A. WEIGL. *Ann. Physik* [iv], 82, 1-15(1927).—The light emitted by H canal rays is polarized so that the component vibrating in a direction parallel to the direction of motion is 30% stronger than the component at right angles. The polarization is due to the moving atoms. An increased potential or pressure causes a changed intensity of the polarization induced in this way. The polarization persists in spite of collisions between moving and stationary atoms. Canal rays in N and in O exhibit no polarization.

B. C. A.

Polarization of canal-ray light. R. DÖPEL AND R. VON HIRSCH. *Ann. Physik* [iv], 82, 16-24(1927).—H canal rays in air exhibit a polarization of 1.12 for H_{β} which is independent of pressure, while for the N 4709 band the value is 1.00. For air canal rays in H, there is no polarization. For at. H in mol. H the value falls from 1.37 at 3600 v. to 1.11 at 32,000 v. For H in O, the value 1.16 ± 0.01 is independent of pressure and voltage. These and other results indicate that the polarization of the emitted light depends on the nature of both the gases present and is in general absent in the absence of an exciting gas.

B. C. A.

Absorption coefficient of helium for its own radiation. A. WOLF AND B. B. WEATHERBY. *Phys. Rev.* [ii], 29, 135-40(1927).—The mass absorption coeff. of He for its own radiation in the extreme ultra-violet is $1.24 (\pm 0.02) \times 10^7$ in the pressure range

0.016–0.040 mm. Below 0.016 mm., the coeff. increases rapidly with decrease in pressure. B. C. A.

Fine structure of the Balmer lines of hydrogen. N. A. KENT, L. B. TAYLOR AND H. PEARSON. *Nature* 119, 163(1927).—Values of $\Delta\lambda$ were obtained as follows: (25 milliamp./sq. cm.) H_{α} 0.1370, H_{β} 0.0791, H_{γ} 0.0669 A. U. (13 milliamp./sq. cm.) H_{α} 0.1391 A. U. A third component on the longer wave-length side of λ' is also present. B. C. A.

Determination of refractive indexes from reflection measurements in the infra-red. A. KREBS. *Ann. Physik* 82, 113–37(1927).—The relation between angle of incidence and reflection has been studied for the residual rays from Ca carbonate, silica and fluorite. The Fresnel formulas fit the reflection data for the transparent substances Se, NaCl, KCl, KBr and CaF_2 . Brewster's law affords a means of calcg. n_s from the angle of polarization corresponding with the reflection data. By combining the Fresnel formulas, a simpler method can be used. The reflection of residual rays from various com. glasses has enabled their n_s to be detd. experimentally. B. C. A.

Absorption of light by ozone between 3050 and 3400 A. U. J. DUTHIEL AND (MME.) M. DUTHIEL. *J. phys. radium* [vi], 7, 414–6(1926).— O_3 exhibits about 23 bands of low persistence in the region 3050–3400 A. U. (Huggins' bands). The wave lengths of max. and min. absorption and the corresponding absorption coeffs. have been redetd. The new data, when applied to the absorption of the atm., yield results for the thickness of the O_3 layer which are in agreement with results based on the great ultra-violet band (2550 A. U.) of O_3 . B. C. A.

Possible cause of the changes of color in vapors. (MRS.) F. LANGWORTHY. *Chem. News* 134, 20–1(1927).—When illuminated by a spark, the vapor of $HgCl_2$ appears green, that of $HgBr_2$ blue, and that of the iodide violet. This is accounted for on the supposition that, as the halogen atom becomes more positive with increasing at. wt., the violet or more negative rays are more likely to be attracted to its vicinity. Elements in the same group of the periodic table become more positive with increasing at. wt. and the conclusion is reached that this increase of positivity is acquired in stages. B. C. A.

Isotopic effect in infra-red absorption spectra. H. K. PYLER. *Phys. Rev.* 28, 284–90(1926), *Science Abstracts* 30A, 15.—The infra red absorption spectrum of brucite shows maxima corresponding to Mg^{24} , Mg^{25} , Mg^{26} and a band possibly due to Mg^{28} . Coblenz's data also show evidence of isotopic effects in Ni sulfate, Ni^{58} and Ni^{60} being observed. With K sulfate 2 isotopes are also indicated. The solid sulfates of Ba, Sr and Mg show complex maxima, but as the light was unpolarized these may be due to pleochroism. Work is proceeding on these substances with definite orientation. H. G.

The absorption of ultra-violet light by copper sulfate solutions. L. KWIECINSKI AND L. MARCHLEWSKI. *Bull. intern. acad. Polonaise* 7a, 247–53(1926); *Science Abstracts* 30A, 376.—Ley and Hegge and later Mecke and Ley have shown that $CuSO_4$ in water does not obey Beer's law (C. A. 19, 1095). The authors have exptd. with a no. of org. substances, and found none that does not follow this law; they detd. the absorption curves by Hilger's method for 2 solns. one twice the strength of the other, the thickness of the first being half that of the second. The absorption curves agreed within the limits of exptl. error. They find that with solns. of $CuSO_4$ with 0.1 mol. and 0.05 mol. per l. the deviation from Beer's law does not exceed the possible exptl. errors, except in the case where the extinction coeff. is 0.1. For more dil. solns. deviations were observed, which are represented graphically. H. G.

Auroral green line 5577 A. U. D. A. KEYS. *Nature* 119, 162(1927).—The results of McLennan, McLeod and McQuarrie (C. A. 21, 1060), indicating that the line is primarily due to O, are confirmed. B. C. A.

Wave length of ruthenium $K\beta_1$. F. H. LORING. *Chem. News* 134, 49(1927).—The wave length of this line has been detd. from the values assigned by Auger and Dauvillier to the K lines, from the exact values of $K\alpha_1$ and $K\alpha_2$, and from the values of $(\nu R^{-1})^{1/2}$ of the K series. The mean of these and of L.'s exptl. value (cf. *Chem. News* 133, 356–8(1926)) is 0.57158 A. U. B. C. A.

Measurement of absorptive power. E. C. C. BALY, R. A. MORTON AND R. W. RIDING. *Proc. Roy. Soc. (London)* A113, 709–16(1927).—The relative merits of the Hilger rotating sector photometric method and the Judd Lewis sector spectrophotometric method (C. A. 13, 1549) for the detn. of extinction coeffs. are discussed. The methods are compared by measuring, with both instruments, the absorptive powers of a thin glass plate, transmitting to about 254 $\mu\mu$, of a neutral-tinted glass plate, and of standard solns. of K chromate and K and Ba nitrates. The results given be-

tween 436 and 254μ agree well within the limits of exptl. error ($\pm 2\%$). In the visible region, the photographic and von Halban's photoelec. methods (cf. C. A. 15, 343) agree with the visual methods. The error of the photographic method, which is $\pm 2\%$ in this region with the dispersion of a Hilger E_2 spectrograph is probably greater than that shown by the photoelec. method and less than that of the visual method. In the region $240\text{--}330\mu$, the photoelec. method gives values which are uniformly smaller than those given by the 2 photometers. It is suggested that von Halban's results are subject to a wave-length error in this region. With solns of Ba and K nitrates, a new discrepancy is superimposed in the short-wave ultra-violet. B. C. A.

Anomalous dispersion of spectra produced by electric excitation of hydrogen, helium, neon and mercury. R. LADENBURG, WITH H. KUPFERMANN AND AGATHE CARST. *Physik Z.* 27, 789-90 (1926); cf. C. A. 20, 3389.—The classical theory of dispersion suggests the occurrence of anomalous dispersion in the spectra of all glowing gases, but as a rule such dispersion could not be detected. By using the very sensitive method of horizontal interference bands anomalous dispersion could be made visible on the following spectral lines when the current d. is less than 1 milliamp.: Ne 6402 ($s_2\text{--}p_0$), He 5876 ($^3P\text{--}^3D$) and Hg 5461 ($^3P_2\text{--}^3S_1$). The s_2 lines of Ne and the red line of H show this effect at current ds above 100 milliamps. The effect increases irregularly with increasing gas pressure until a max is reached, this is 1 mm. in the case of Ne and $1\frac{1}{2}$ mm. in that of H. EMIL KLARMANN

Magnetic separation of the mercury line 5770 into a nonet of special type. H. NAGAOKA AND T. MISHIMA. *Proc. Imp. Acad. (Japan)* 2, 479-80 (1926).—When resolved in a field of 27,000 gauss, the p components consist of a triplet in which the sepn. amts. to ± 0.083 A. U., and in which the n -components are sym. situated about the initial position of the line, and consist each of 3 components sepd. from the initial line by ± 1.0 , ± 1.083 and ± 1.66 A. U. B. C. A.

Double normal state of the arc spectrum of fluorine. T. L. DE BRUIN. *Nature* 118, 804 (1926).—The line 606.9 is identified as a $^4P^2P'$ combination, and the lines 657.69, 658.31 as a 2P combination. One of the 2P term differences 145.5 (0.02 volt) or 325.6 (0.04 volt) is assigned to the double normal state ("Grundterm") of the F atom. B. C. A.

Impact-broadening of spectral lines and the sharpness of quantum states. G. HETTINGER. *Physik. Z.* 27, 787-9 (1926).—Theoretical. The sharpness of a quantum state depends strictly on its duration period. Whether a quantum theoretically, equiv. to the collisional damping of Lorentz can be found is discussed. It has been shown that addn. of foreign gases can in fact bring about a broadening of lines by collisions. The breadth and broadening of lines in the ultra-red rotation and rotation-vibration spectra of gases with pressure increases are regarded as essentially due to impact-damping. B. C. A.

Line-spectrum of wave lengths of a few decimeters. G. MITT. *Physik. Z.* 27, 792-5 (1926).—Weichmann (C. A. 16, 684) has measured n of water for wave lengths, from 27 to 65 cm., and has found several sharply defined regions of anomalous dispersion. The water he employed has a cond. varying from 20×10^{-6} to 40×10^{-6} . When specially purified water of cond. 2×10^{-6} is used, no trace of anomalous dispersion is found, and the n of water is 8.975 approx. over the range 52-58 cm. Weichmann's results can be reproduced by adding a trace of a soln. made up from NaHSiO_3 . The curve, refractive index vs. wave length, shows 3 max. between 54 and 57 cm. The curve for clean solns. of NaHSiO_3 can now be expressed by the ordinary dispersion formula, the resonance wave lengths being 54.49, 55.55 and 56.29 cm. The physical interpretation of the curve is discussed. B. C. A.

Optical constants of single-crystal bismuth. L. H. ROWSE. *Phys. Rev.* 27, 247 (1926).—The extinction modulus and n for light traveling parallel to the optic axis were detd. by measuring the ellipticity produced by reflection from the cleavage surface of single-crystal Bi. A Stokes analyzer was used and readings in the visible spectrum only were taken. n rises from 1.05 at 470μ to 1.55 at 670μ , while the extinction modulus rises from 2.7 to 3.6 over the same range. R. L. HERSHEY

The emissivity of thorium oxide. W. E. FORSYTHE. *Phys. Rev.* 25, 252 (1925).—The black-body emissivity of ThO_2 was 0.40 when heated either with oxy-H or oxy-gas flames. F. O. A.

The cause of the colors shown during the oxidation of metallic copper. F. HURN CONSTABLE. *Proc. Roy. Soc. (London)* A115, 570-88 (1927).—The change in color developed during the oxidation of Cu rods whether massive or deposited on china has been followed through 3 orders. A definite color was developed by heating the

rod to a given temp. in air in a furnace, after which the color was fixed by sudden evacuation. The change in thickness was closely correlated with the color by following the change in mass, or the decrease in pressure of the oxidizing gas or the change in elec. cond. of a Cu film on a china rod. The colors are shown to be interference colors. A dull film scatters negligible light, while if highly polished the scattering is marked from green films.

F. O. ANDEREGG

The value of spectrography in theory and practice. S. A. SCHOU. *Dansk Tids. Farm* 14, 419-28(1927).—A brief historical outline is given of the study of absorption spectra in which the importance of quant. spectrography to chemistry is pointed out. Reference is made to the fact that an increase in the conjugate double bonds in many org. compds. is accompanied by an increase in their absorbing power. Thus, stilbene and its derivs. will show a gradually increasing absorption in passing from the lower to the higher homologs with increasing alternating double linkages between the 2 extreme phenyl groups. Similar results are obtained by increasing the no. of carbonyl groups in certain org. mols. Such problems as the question of the constitution of $\text{CH}_3\text{COCH}_2\text{COOC}_2\text{H}_5$ have been solved by the aid of spectrography since the spectrographic results can be checked by a suitable Br titration, which follows closely the equil. between the keto and the enol forms of this ester. It is possible to obtain accurate results since the double bond between two C atoms causes an absorption about 10,000 times as strong as that produced by the carbonyl group. S. shows spectrographically the existence of an enol form of acetaldehyde, $\text{CH}_3\text{CHO} \rightarrow \text{CH}_2 = \text{CHOH}$. Because the absorption band, which is produced by alural in a non-aq. solvent and which is due to the aldehyde group, disappears in chloral hydrate solns. it is believed that the water in the hydrate is present as a hydroxide rather than water of crystn. The quant. aspect of spectrography is expressed in the equation $E = \log(I_0/I) = \epsilon cd$, where E represents the extinction of light, I_0 the intensity of the light entering the substance, I that of the light leaving it, ϵ the coeff. of extinction (which varies only with the wave length and the nature of the substance), c the concn. and d the thickness of the absorbing substance. From this equation the relationship $\epsilon = (n/cd) \log(I_0/I)$ can be derived, in which n is a const., t_0 the time of exposure (spectrum photography) for the solvent, and t that for the soln. By varying c and d the value of ϵ can be obtained for different wave regions and a graphic relationship established between ϵ and the wave lengths in A. U. Practical use is made of spectrographic detn. of the purity and the concn. of substances in soln. It is applicable to forensic chemistry in dealing with alkaloids. Since the spectrum from a vapor is more discontinuous than that from a soln. the study of vapor spectra is more suited to a detailed investigation of mol. absorption than soln. spectra. Vapor spectrography lends itself in a practical way to a quant. measure of the concn. of absorbing gases. For example, it is possible to det. accurately 0.001 mg. CaH_2 in a vol. of one l.

E. O. ELLINGSON

The wave length of the green auroral line in the oxygen spectrum. J. C. McLENNAN AND J. H. McLEOD. *Proc. Roy. Soc. (London)* A115, 515-27(1927).—With a Fabry-Perot interferometer the wave length of the green line of O was measured as 5577.341 A. U., practically identical with the value 5577.350 A. U. found by Babcock for the auroral line. This strengthens the conclusion that the auroral line has its origin in O in the upper atm.

C. C. KIESS

The hydrogen band spectrum: new band systems in the violet. O. W. RICHARDSON. *Proc. Roy. Soc. (London)* A115, 528-48(1927).—Lines in the violet portion of the secondary spectrum of H which are strengthened when H_2 is excited by direct electron impact have been arranged into a system of bands. Only the Q branches are as yet worked out but the evidence indicates the existence of P and R branches as well. These bands are degraded toward the violet opposite to those previously described (C. A. 20, 2949; 21, 705). The details of the analysis are given in comprehensive tables.

C. C. KIESS

Transmission properties of some filters. E. PETTIT. *Astrophys. J.* 66, 43-58 (1927).—The detn. of transmissions between $\lambda = 230 \text{ m}\mu$ and $450 \text{ m}\mu$ were made photographically with a 1-m. concave grating spectrograph; those of wave lengths longer than $\lambda = 450 \text{ m}\mu$ were made with a monochromatic illuminator and vacuum thermocouple. **Standards of wave length in the infra-red.**—A table of wave lengths of easily recognized features of absorption spectra is given for the region $\lambda = 740 \text{ m}\mu$ to $\lambda = 2.1 \text{ }\mu$ which may be used where accuracy greater than $0.01 \text{ }\mu$ is not required. **Transmission data.**—The transmission curves of 44 filters are given from $\lambda = 0.23$ to $\lambda = 2.3 \text{ }\mu$ and in several cases to greater wave lengths in the infra-red. **Photochemical effects.**—The effect of sunlight on green celluloid, glass, Ag and Au films has been studied. Solarized green celluloid is a valuable filter transmitting the infra-

red with an efficiency of 80-90%, has a sharp cut-off at $\lambda = 0.4 \mu$ and transmits nothing from this point to $\lambda = 0.23 \mu$.

E. P. WIGHTMAN

Studies of the Becquerel effect. I. I. LIFSCHITZ AND S. B. HOOGHOUT. *Z. physik. Chem.* **128**, 87-109(1927); cf. *C. A.* **21**, 2097.—It is shown experimentally that the Becquerel effect is independent of the H-ion concn. in solns. of dyes. The effect depends upon secondary changes occurring in solns. of simple electrolytes with Pt electrodes. Both pos and neg. effects were observed depending upon the nature of the ions of simple electrolytes. Substances which are sensitive to light in the ordinary sense often show no effect. Impurities often exert a very great influence upon the effect. At reversible electrodes of metal against metal ions or H against H ions no effect is observed. It occurs only in polarizable electrodes or phase boundaries.

F. O. ANDEREGG

The life period of resonance phenomena. F. FUES. *Z. Physik* **43**, 726-40(1927).—Atoms with several like electrons may exist in excited states, whose energies are equiv. to the state of the concerned ions, so that a probability results that they so pass spontaneously into these with electron emission. This transition process can be followed by wave mechanics and in this way a life period for the first state and a theoretical value of the above possibility can be calcd. If one compares with it the possibility of a transition to a not excited state of the atoms with emission of a light quantum, the order of magnitude of both proves the Auger expt. of the fluorescent yield of absorbed Röntgen rays. The influence of the spontaneous conversion possibility on the dispersion is discussed.

MARIE FARNSWORTH

Fine structure of cadmium lines in the ultra-violet. W. MOHAMMAD AND S. B. L. MATHUR. *Phil. Mag.* [7], **4**, 112-20(1927).—M and L investigated the fine structure of prominent Cd lines in the spectral region between 4800 and 2775 Å. U. Their work is in generally good agreement with MacNair (cf. *C. A.* **20**, 3636).

G. G.

Band spectra associated with silicon. W. H. B. CAMERON. *Phil. Mag.* [7], **3**, 110-5(1927).—An attempt is made to produce band spectra of Si compds analogous to the band spectra of C (due to CO or CO⁺). The Si used was only commercially pure and the spectra obtained may be due to impurities.

GEORGE GLOCKLER

Correction to our article: The relations between fluorescence and phosphorescence in solid and liquid media. S. I. VAVILOV AND V. L. LEVSHIN. *Z. Physik* **44**, 539(1927); cf. *C. A.* **20**, 3132.—New results indicate that U salts in the solid state show only phosphorescence and no fluorescence, in contrast with the results obtained with other phosphorescent substances.

F. A. JENKINS

Ultra-violet fluorescence of IBr vapor. A. FILIPPOV. *Naturwissenschaften* **15**, 682-3(1927).—A fluorescence band spectrum (9 bands) between 3000 and 3500 Å. U. was found for IBr. Addn. of N₂ at 260 mm.-pressure caused bands to appear up to 3800 Å. U. Excitation of Br₂ or ICl by quartz filtered ultra-violet light was without result. Irradiation of ICl by Al spark yielded weak violet luminescence from I₂.

B. J. C. VAN DER HORVEN

Blue zirconium from Siam and its behavior toward Becquerel rays. HERMANN MICHEL AND KARL PRZIBRAM. *Anz. Akad. Wiss. Wien* **62**, 49-52(1927).—The change in color under the influence of Ra and cathode rays and the changes on heating are described.

MARIE FARNSWORTH

Contribution to the luminescence and change of color of alkali chlorides treated with Becquerel rays. EDUARD JAHODA. *Sitz. Akad. Wiss. Wien, Abt. IIa* **135**, 675-703(1927).—J. studies the luminescence and the change of color of a rock-salt crystal from Stassfurt, which exhibits a red radiophotofluorescence. The results are compared with those obtained with rock salt from Wieliczka. Following are the characteristic differences: Red radiophotofluorescence; increase in the luminescence properties; initial red color, which shifts to yellow-green by radio- or thermoluminescence; faster rise, higher max. and slighter stability of the color change; no appearance of blue light. As in the case of common rock salt, the max. of the absorption spectrum is at 460mμ; the max. of the excited red radiophotofluorescence is at 495mμ. A chem. analysis and the use of artificial crystals contg. metallic particles have proved that the red radiophotofluorescence of the crystal from Stassfurt is to be attributed to traces of Mn. Artificial NaCl crystals contg. various metals have been obtained by fusion. They show the same peculiar properties as the natural crystals, but increased to a larger extent. The metallic inclusions have a considerable influence on the luminescence power, but only a very slight on the absorption spectrum. The fusion broadens the absorption bands. Crystals of the remaining alkali chlorides have been prepd. by fusion. They exhibit the same peculiarities as do artificial NaCl crystals, with

the only important exception that the fusion increases the color change, but at the same time stabilizes it. The absorption spectra of RbCl and CsCl have their max. at 610μ and 560μ , resp.

A. L. HENNE

Color change and luminescence in Iceland spar submitted to Becquerel rays. LUISA GRÖGER. *Sitz. Akad. Wiss. Wien., Abt. IIa* **135**, 705-14(1927).—Iceland spar was illuminated with β - γ rays of intensities 1, 0.52, 0.31, 0.17 and 0.137, resp. The effect of the radiation duration on the absorption coeff. and the luminous total was studied. In first approxn. both relations are of the type $n = n_{\infty}(1 - e^{-\beta t})$. A quant. study of the relation of the max. of the color change and the total amt. of light to the radiation intensity indicates that $n_{\infty} = \alpha j / (\beta_1 j + \delta)$ (cf. Przibram, *C. A.* **21**, 1411). These exptl. results are criticized from a theoretical standpoint. Finally it has been qual. found that an increase in the radiation duration causes the radiofluorescence to become brighter.

A. L. HENNE

Extinction of the retarded luminescence in mercury vapor. S. PIENKOWSKI. *Compt. rend. soc. Pol. de phys.* **1925**, Part 4, 7-16; *Physik. Ber* **6**, 1633.—Rapidly moving Hg vapors were excited by electronic bombardment. An elongation of the luminescence band occurs in the direction of movement. From the marked asymmetry and the observations with the revolving mirror it is evident that a retarded luminescence is present. Photographs of the luminescence spectra show various extinctions for the different wave lengths. Photometric measurements made in the direction of the beam indicate for individual wave lengths an exponential relation to the extinction. This indicates that the no. of atoms which change from condition a to b in unit time is proportional to the total no. in condition a.

E. R. SCHIERZ

Elementary mechanism of photochemical action. V. HENRI AND R. WURMSER. *J. phys. et radium* **8**, 289-310(1927).—According to Einstein's law the no. of mols. reacting in a photochem. change is equal to the no. of quanta absorbed in the same time. Most photochem. reactions do not follow this law; the relation between the velocity of the reaction and the energy absorbed is not inversely proportional to the frequency. These reactions are made up of a series of partial reactions, of which the first, the elementary photochem. phenomenon, obeys Einstein's law. This elementary phenomenon is either a simple activation of the mol., a predissociation or a dissociation. By a study of the various properties of the substance and the effects of outside influences, it is possible to det. for a gaseous reaction which of the 3 above modes of action is responsible for the photochem. change. There exist certain simple reactions for which Einstein's law may be verified.

S. M. GERHARD

Production of ozone in air by ultra-violet rays. J. DADLEZ. *Compt. rend.* **185**, 89-91(1927).—Air confined in a space of 18 cu. m. was made to aspire at variable distances from a George quartz lamp of 1500 c. p. The amt. of ozone produced varies with the distance of the air column from the lamp. Similar results were obtained with the Gallois and Chénaille lamps. The quartz lamp under ordinary conditions does not produce enough ozone to make the air unfit for respiration.

L. W. R.

The action of light on chlorine. G. B. KISTIAKOWSKY. *J. Am. Chem. Soc.* **49**, 2194-200(1927).—All theories which assume the presence of foreign mols. to be necessary for the primary photochem. process assume simultaneously that pure Cl_2 , and similarly Br_2 , do fluoresce. An approx. detn. of the convergence limit gave 4790 A. U. with an accuracy of about 10 A. U. thus confirming the results of previous investigators. In expts. on the absorption of light by dry and moist Cl_2 , av. results for the % of the total radiation absorbed were 8.75 and 8.90, resp. The fraction of absorbed light energy which is reëmitted as fluorescence by dry Cl_2 must be very much smaller than the upper limit of 5% detd. by means of a thermopile. The structure of the absorption spectrum and the total absorption of Cl_2 are not appreciably changed by extreme drying. The decrease of the Budde effect on drying Cl_2 is, however, real. Since fluorescence is absent and the extent of absorption is unchanged, it is concluded that one and the same amt. of light energy introduced may or may not cause a heating effect, depending only on the presence or absence of impurities in Cl_2 .

J. H. PERRY

The action of light on concentrated aqueous solutions of ammonium thiocyanate. S. S. BHATNAGAR, H. B. DUNNICLIFF AND MOHAMMAD ALI. *Quart. J. Indian Chem. Soc.* **4**, 229-38(1927); cf. *C. A.* **20**, 3645.—The red color which appears when sunlight falls on concd. NH_4CNS solns. has been ascribed to colloidal S. It could be due to $\text{Fe}(\text{CNS})_3$. The Fe could come from the glass. But the color appears at the same time in quartz tubes, in glass tubes, and in tubes to which a little $\text{Fe}(\text{ClO}_4)_3$ has been added. Then Fe cannot be the cause. The color appears first in the most concd.

solns. Solns. less concd. than 3.5 *N* do not become colored. The first color appears in concd. solns. exposed to direct sunlight in 10 sec. and is definite in 1 min. A ppt. appears in about 5 hrs. Expts. with a light filter showed that wave lengths longer than blue had no effect; and blue, violet and ultra-violet were increasingly effective. Dry crystals were not discolored. Stored solns. were discolored as readily as fresh solns. The presence of acids promotes the development of the color and the presence of base prevents its formation. Boiling and some solvents discharge the color, one solvent, ether, dissolves the colored substance. H_2S discharges the color. Little or no color is developed in the absence of air, unless oxidizing agents are present. H_2O_2 and other oxidizing agents produce the same color and ppt. as air and sunlight. Absorption spectra (5 plates reproduced) for the mixts. colored by sunlight, Hg vapor arc, and iron arc, and those colored by oxidizing agents are similar. The analysis of the ppts. from irradiated and oxidized solns. is the same. NH_4CNS or $KCNS$ is hydrolyzed to form $HCNS$. $HCNS$ is oxidized to produce CNS , which produces the color. CNS polymerizes to form $(CNS)_n$, which is the ppt. Light promotes oxidation by atm. O_2 .

F. E. BROWN

The quantum yield in the action of Röntgen rays on silver bromide. J. EGGERT AND W. N. DDACK. *Z. Physik* **43**, 222-9 (1927).—In the photolysis of the $AgBr$ of a photographic film by means of Röntgen rays, the quantum yield is about 1000 Ag atoms per $h\nu$, measured for $\lambda = 0.45$ A. U. Each absorbed $h\nu$ makes it possible to develop one grain of $AgBr$. When a screen of $CaWO_4$ is illuminated by means of Röntgen rays, every $h\nu$ from Röntgen source generates at least 30 $h\nu$ of blue fluorescence light.

A. L. HENNE

Effect of chemically active rays on gelatin. H. BRINTZINGER AND K. MAURER. *Kolloid-Z.* **41**, 46-50 (1927).—Gelatin subjected to the rays from a quartz lamp was altered so that its tendency to swell in water was lessened, the effect being proportional to the duration of illumination. Further, the soly of the swollen gelatin in water was reduced, prolonged boiling being necessary to effect dissolution. Elementary analysis failed to detect a difference, but the irradiated specimen was found to reduce ammoniacal silver nitrate soln. The same effect was observed when the gelatin was irradiated in an O -free atm., but was considerably reduced by rigorous purification of the gelatin. The effect of light is dependent on the presence of an iron catalyst normally found in the ash of gelatin.

B. C. A.

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4—ELECTROCHEMISTRY

COLIN G. FINK

The future of electrochemistry and electrometallurgy in the Belgian Congo. R. SEVIN AND LÉOPOLD HERRY. *J. four elec.* **36**, 193-5(1927). C. G. F.

The Rennerfelt electric furnace. G. SEPULCHRE. *Aciers spéciaux* **2**, 514-9 (1926); *Chimie et industrie* **18**, 250(1927).—Description of the furnace and discussion of its merits. A. PAPINEAU-COUTURE

Electric furnace used in annealing cylinders for air-cooled engines. I. S. WISHOSKI. *Fuels and Furnaces* **5**, 1199-202(1927).—The furnace and its operation are described. E. H.

The production of cast iron and synthetic pig iron in the electric furnace. H. STAMM. *Continental Met. Chem. Eng.* **2**, 135-8(1927).—An outline covering progress in the production of gray Fe and of synthetic pig Fe in the elec. furnace. The presence of Al and of Ca as metals or as carbides in cast Fe is discussed. The presence of SiC has not been established. The difficulties connected with the production of elec. pig Fe have been largely solved and may be practically eliminated by correct smelting. The only difference between elec. and cupola gray Fe is the replacement of coke by the heating effect of the elec. arc. Closed elec. furnaces are most commonly used. Elec. furnace smelting of gray Fe saves Fe, Si and Mn; slag production is very low and the entire charge is introduced at once. The quantity and quality of the C added are important. To obtain similar properties in low-C gray Fe to those of cupola gray Fe, the C content of the elec. product must be maintained 0.2% higher, for Fe of the same general compn. The non-continuous operation of the elec. furnace is a disadvantage where large castings are involved. W. H. BOYNTON

The aluminum industry of Japan. ANON. *J. four elec.* **36**, 200(1927).—Japan does not yet figure as a producer of Al but is a heavy importer of the metal. In 1926 5000 tons were imported as against 500 tons in 1915. C. G. F.

New process for the preparation of boron. L. ANDRIEUX. *Compt. rend.* **185**, 119-20(1927); cf. *C. A.* **21**, 1413. —Electrolyzing a molten bath having the compn. $2B_2O_3 + MO + MF_2$ gives at the cathode either the metal M or a boride of this metal mixed with a greater or less proportion of B. In the first case only the oxide MO is decompl., while in the second, the metal M reduces the B_2O_3 of the bath, liberating B, which combines partly or wholly with M. On carrying out the electrolysis at 1000-1200° with baths yielding metals which can reduce B_2O_3 , A. found: (1) with alkali borate and fluoride the results are similar to those obtained hitherto with $Na_2B_4O_7$ or $K_2B_4O_7$; alone (low yield of very impure B), (2) with alk. earth metals or earth metals the cathode deposit consists mainly of the boride of the metal, but with Mg the product may consist almost entirely of B. Electrolyzing at 1100° a bath consisting of $2B_2O_3 + MgO + MgF_2$ in a graphite crucible (as anode) gives a cathode deposit of B agglomerated by part of the solidified electrolyte. Pulverizing and treating the deposit with HCl gives a residue of amorphous B, which, after drying *in vacuo* at 140°, contains up to 95% pure B; it may be further purified by fusing in dry H₂ according to Weintraub (*C. A.* **5**, 2221; **7**, 2022). The process can be made continuous, as the cathode can be withdrawn from the bath and replaced without fear of igniting the B. The current efficiency can reach 95%. A. P.-C.

Preparation of alkali and alkaline-earth amalgams; electrolytic production of barium compounds. OCTAVE DONY-HÉNAULT AND FRANCIS MEUNIER. *Chimie et industrie Special No.*, 431-4(May, 1927).—Insol. or sparingly sol. alkali or alk.-earth salts (e. g., $NaHCO_3$ or $BaCO_3$) can be readily electrolyzed in suspension in a soln. of a sol. salt of the same metal, using a Hg cathode to amalgamate the liberated alkali or alk.-earth metal. In electrolyzing a suspension of $BaCO_3$ in $Ba(ClO_3)_2$ or $Ba(ClO_4)_2$, the Ba liberated at the cathode is amalgamated and the ClO_4 liberated at the anode immediately attacks the $BaCO_3$, regenerating the electrolyte. The $Hg_{12}Ba$ formed is not oxidized by $Ba(ClO_3)_2$ or by $Ba(ClO_4)_2$ in neutral or alk. soln., and highly concd. solns. of the electrolyte may be used with almost quant. yields and very high (nearly 100%) current efficiencies at current densities of 3000-4000 amps. per dm.² The industrial possibilities of the process, particularly for the cheap production of Ba compds. of a high degree of purity, are discussed. A. PAPINEAU-COUTURE

Aluminum and bauxite. R. S. MCBRIDE. *Mineral Ind.* **35**, 11-47(1926).—World production, metallurgy, new alumina processes, and uses are covered. A. BUTTS

A study of the influence of variables on the structure of electro deposited copper. A. KENNETH GRAHAM. *Trans. Am. Electrochem. Soc.* **52**, (advance copy), 23 pp.(1927).—A

study of the variables in the electrodeposition of Cu, namely, the influence of the base metal, metal concn. of electrolyte, acid concn. of electrolyte, agitation, c. d., temp., addn. agents and the cathode potentials, in conjunction with each of the above variables, was made under uniform conditions, with an acid copper sulfate electrolyte. Their effect upon the structure of the electrodeposited metal was observed, and the relation of cathode polarization to the structure of the deposit was noted. Additional confirmation was obtained of the evidence that the base metal influences the structure of electrodeposited Cu. A simple device for maintaining a const. soln. level and a new design of calomel electrode for preventing diffusion of KCl into an electrolyte were employed. C. G. F.

Electrolytic deposition of metals on an industrial scale. PH. NAVILLE. *Chimie et industrie Special No.*, 405-7 (May, 1927).—Brief discussion of the effects of the compn. of the electrolytic bath, and particularly of the addn. of relatively small amts. of various cations and anions, on the character of the deposit. A. P. C.

Observations on chromium plating. F. R. PORTER. *Brass World* **23**, 267-9; *Metal Ind.* (N. Y.) **25**, 375-7 (1927).—The bath recommended is CrO_3 16-32 oz./gal. (120-240 g./l.), $\text{Cr}_2\text{O}(\text{CO}_3)_2$ 1-2 oz./gal. (7.5-15 g./l.), $\text{Cr}_2(\text{SO}_4)_3$ 0.4-1 oz./gal. (3-7.5 g./l.). Some discussion of the historical development of the use of these constituents is given. 40° to 46° C. (110° to 115° F.) is recommended as the most satisfactory range for bright plating. Parts with plane surfaces were plated with about 70-350 amps. per sq. ft. but with irregular-shaped objects 200-250 amps./sq. ft. were generally required to obtain a continuous deposit covering the recessed portions as well as the projecting parts. The quantity of CrO_3 in the bath had practically no effect upon the deposit within the limits used (16 to 32 oz./gal.). Likewise the quantity of carbonate present had little or no effect. The sulfate, however, caused trouble unless carefully controlled. More than 0.4 oz./gal. resulted in reducing the apparent throwing power. Many details of technic in the application of Cr plating are discussed. In the protection of Fe against rust Cr plate is applied as a finish over Cu or Ni plate as it does not protect Fe from rusting when used alone. G. DUBPERNELL

Electrodeposition as corrosion preventive. S. WERNICK. *Brass World* **23**, 251-2 (1927).—Zn and Cd protect because they are anodic to Fe but it is pointed out that a few ten-thousandths of an in. of such metals as Cu, Ni and Sn are totally inadequate because of the generally porous nature of the Fe base. The deposit may cover up the small pores in the base metal but will not enter comparatively large crevices. The porous base metal frequently exerts a sponge-like action and absorbs the solns. into which it enters and these later influence corrosion. About 0.0005 in. of Zn gives satisfactory results; it should be as free as possible from impurity; Sb, Fe and Cu are especially to be avoided in the bath. Cd is beginning to replace Zn to a considerable extent. G. DUBPERNELL

The pressure factor in electrolysis. B. WAESER. *Continental Met. Chem. Eng.* **2**, 141-2 (1927).—It is shown that in the electrolytic production of highly compressed gases the voltage need hardly be increased beyond the value required for carrying out the process at ordinary pressures—the benefits of compression being obtained practically without additional current cost. The size of the gas bubbles formed in the electrolyte is smaller, because of the smaller vol. occupied by compressed gas. This tends to eliminate disagreeable accompaniments of electrolysis at ordinary pressures, and facilitates the sepn. of the gases from the electrolyte. The smallness of the bubbles evolved causes a decrease of the conversion resistance, accompanied by an almost violent development of gas, permitting the use of a higher amperage and the attainment of much higher capacities per electrode area. Pressure possesses a strong influence on the cond. of the electrolyte, the resistance of aq. soln. against the passage of the elec. current growing smaller with increasing pressure, the degree of change depending upon the kind and concn. of the soln. Several patents embodying the employment of pressure-electrolysis are briefly reviewed. W. H. BOYNTON

Electrolytic white lead. ANON. *Paint, Oil and Chem. Rev.* **84**, No. 8, 10 (1927).—A process description of electrolytic refining of Pb bullion and its conversion to white lead by the Sperry method. R. J. MOORE

Iron as an impurity in the lead accumulator. I. Capacity loss due to self-discharge. II. Permanent capacity loss. Adsorption and desorption of iron by the positive plate. F. M. LEA AND J. T. CRENNELL. *Trans. Faraday Soc.*, (advance copy), 1927.—Expts. of a semi-quant. nature were carried out initially at lab. temps. by selecting groups of 4 cells of equal capacity, as detd. by a long series of preliminary cycles of charge and discharge, and introducing Fe into the cells so that in any one group the Fe concns. in the electrolyte were 0.1, 0.01, 0.001 and zero g. of Fe per 100 cc. In actual practice the "zero" cell always contained some Fe derived from the

cell materials which was not completely removed by changing the electrolyte. There were 2 types of capacity loss proportional to the Fe concn. in a cell. (a) A cell contg. Fe when discharged after various periods of standing was found, compared with a cell with pure electrolyte, to show a loss of capacity increasing with time. This loss is termed the "self-discharge loss" and is due to the action of the Fe as suggested by the Dolezalek theory. (b) A cell contg. Fe, if discharged immediately after charge, exhibits a loss of capacity compared with a cell contg. pure electrolyte. This loss is termed the "permanent" loss as it has been shown that it cannot be due to self-discharge similar to (a) during the period required for discharge. A close check was kept on the electrolyte Fe concns. of all cells. The Fe tends to become unequally distributed throughout the electrolyte of a cell, the concn. increasing toward the bottom. In addn. the Fe is adsorbed by the positive plate (PbO_2), and the resulting equil. is dependent on a no. of factors. This adsorption is related to the permanent loss occurring in a cell contg. Fe. There is an approx. linear relation between the Fe content and the self-discharge loss, but the rate of loss tends to decrease with time. The normal action of Fe on the neg. plate is expressed by the equation: $\text{Pb} + \text{Fe}_2(\text{SO}_4)_3 = \text{PbSO}_4 + 2\text{FeSO}_4$. The increase in weight of a pos. plate immersed in H_2SO_4 soln. contg. Fe^{++} , as compared with a similar plate in a pure acid, is in agreement with the equation: $\text{PbO}_2 + 2\text{FeSO}_4 + 2\text{H}_2\text{SO}_4 = \text{PbSO}_4 + \text{Fe}_2(\text{SO}_4)_3 + 2\text{H}_2\text{O}$. The rate of self-discharge is proportional to the electrolyte Fe concn. and increases with temp. The titanous chloride method for detg. Fe has been applied to the estn. of small traces of Fe in H_2SO_4 solns. The relations between the permanent loss occurring in a cell contg. Fe and the adsorption of Fe by the positive paste have been studied. The permanent loss has been measured for a series of temps., Fe concns. and discharge rates. The adsorption of Fe by the positive paste increases with decreasing acid concn. and also with increase in temp. This adsorption has been attributed to the presence of a hydrolysis product of $\text{Fe}_2(\text{SO}_4)_3$. The adsorption by the PbO_2 is to a large extent irreversible, but desorption is produced by the elec. working of cells in which the paste and electrolyte Fe concns. are not in equil. The permanent loss and the adsorbed Fe concn. are connected approx. linearly. The permanent loss is recovered by the renewal of electrolyte in proportion as the Fe concn. is reduced. Both H_2SO_4 and $\text{Fe}_2(\text{SO}_4)_3$ are adsorbed by the PbO_2 , but the latter is adsorbed more strongly. The permanent loss has been attributed to this preferential adsorption of the Fe and a theory of the action has been suggested.

C. J. BROCKMAN

The function of inert substances in lead accumulators. O. SCARPA. *Chimie et industrie Special No.*, 408-9 (May, 1927); cf. C. A. 13, 1049.—The beneficial effect of BaSO_4 when added in the grid is due to its retarding action on the transformation of spongy into massive Pb, the BaSO_4 particles interposed between the small crystals of reduced Pb decreasing or preventing their growth at the expense of neighboring crystals. This effect increases with the fineness of the BaSO_4 particles. The p. d. between lampblack and H is practically negligible, while between spongy Pb and H it is 0.38–0.65; as a result, when an accumulator contg. lampblack in the grid is recharged, minute gas bubbles are formed on the lampblack particles, thus regenerating the porosity of the grid each time the accumulator is recharged. In addn., lampblack may also function in the same way as BaSO_4 . Addn. of *pptd.* SiO_2 in the grid is injurious, because adsorption of PbSO_4 by the SiO_2 greatly accelerates sulfation of the grid.

A. PAPINEAU-COUTURE

Light copper-zinc storage batteries. B. L. RÖSING AND (MISS) I. P. DMITRIENKO. U. S. S. R. *Sci. Techn. Dept. Moscow No.* 147, 11 (1926); *Science Abstracts* 30A, 234. (In German.)—The employment of cells of the Daniell type as accumulators of small capacity (up to 0.1 amp. hr.) is proposed. The given construction provides light cells which can be regenerated by current and show no local reactions. They are especially suited for high-tension batteries. The wt. of a battery of 200 v. is 1.5 kg.

E. H.

Some current-time relations in the aluminum cell. [Tantalum.] W. E. MESERVE. *Phys. Rev.* 30, 215–21 (1927).—The relation between the current and the time in an Al cell with the Al as anode and with d. c. applied has been investigated. App. and methods for obtaining data are described whereby many of the past difficulties have been overcome. The results obtained are in agreement with the theory of Guthe (*Phys. Rev.* 15, 327 (1902)) as modified by Fitch (C. A. 11, 917). After the lapse of a certain time (t_0), which was found to be 300 sec. from the moment of applying the v., the dependence of current on v. conforms to the relation $E/i^2 = Ct + D$. From this is deduced a linear relationship between E/i and the quantity of electricity passing through the cell, $(E/i) - (E/i_0) = Cq/2$. The slope, $Cq/2$ is in the nature of a resist-

ance and assuming that it represents the resistance of the oxide layer, the thickness and resistivity (3.403×10^{12} ohm/cm.) of the layer are computed. The data obtained show that the slopes of these lines vary inversely with the square of the anode areas which checks with the theory. Results obtained by Gunther-Schulze (*C. A.* 15, 2232) with Tu are compared and are shown to check the theory. After a short time of closed circuit the opposition to the flow of current when the Al is the anode is shown to be due primarily to the ohmic resistance of the solid layer which increases in value with time of closed circuit.

BERNARD LEWIS

The use of carbon dioxide in a mercury interrupter. G. R. PARANJPE AND H. D. TENDULKAR. *Nature* 120, 117-8(1927).—The efficiency of a Hg interrupter using CO_2 and also H_2 as a dielec. instead of coal gas is tested. The efficiency is greater with either than when coal gas is used.

MARIE FARNSWORTH

Tests for transformer oils. F. BEUVELOT. *J. four. elec.* 36, 197(1927).

C. G. F.

The electrodeposition of rubber and the anode process (STEVENS) 30. Properties and economic importance of acid electric steel (GRINBERG) 9. Reactions of incandescent W with N and with water vapor (SMITHELLS, ROOKSBY) 6. W (PINK) 9.

Electric batteries. G. WEISSMANN. *Brit.* 262,049, Nov. 30, 1925. Structural features.

Batteries with liquid electrolyte. H. T. HARRISON and G. CAMPBELL. *Brit.* 262,016, Jan. 13, 1926. Structural features.

Storage battery. L. G. BOWEN. U. S. 1,642,224, Sept. 13. Structural features.

Storage battery. J. STONE & Co., LTD., AND A. H. DARKER. *Brit.* 262,528, Sept. 14, 1925. Structural features.

Storage battery with a device for indicating the electrolyte level. R. E. CURTIS. U. S. 1,643,238, Sept. 20.

Oxide cathode. G. I. HERTZ. *Can.* 272,708, July 26, 1927. Oxide cathodes are manufd. by coating a body, of which at least part of the surface consists of CuO , with 1 or more alk. earth metals, after which it is heated in a non-oxidizing atm. so that the alk. earth metal melts. The alk. earth metal is then at least partly oxidized and the body is heated in a reducing atm.

Primary cell and electrolyte. G. W. HEISE. *Can.* 273,488, Aug. 30, 1927. A galvanic cell electrolyte comprises caustic alkali and bentonite.

Diaphragm for electrolytic apparatus. J. BILLITER and SIEMENS & HALSKE, AKT-GES. *Brit.* 262,470, Dec. 23, 1924. A diaphragm is formed with fibrous foundation material, such as asbestos, and a filler and binder free from compds. of any metals which could be sepd. during electrolysis, e. g., colloidal CaF_2 and viscous salt solns., such as those of Ti oxalate or Al formate. The diaphragm is moistened before use and may be protected on the anode side by a layer of glass fleece or glass netting. A glass fabric may also be used as a foundation material. Cf. *C. A.* 21, 210.

Electrolytic copper from ores. H. S. MACKAY. *Brit.* 262,546, Sept. 24, 1925. A soln. of Cu and Zn sulfates such as may be obtained from ore is electrolyzed to effect deposition of Cu until the concn. of $CuSO_4$ is low relative to that of $ZnSO_4$ and the $ZnSO_4$ is then crystd. out by evapn. An app. and various modifications of procedure are described. Cf. *C. A.* 20, 3397.

Electrolyte for nickel plating. H. GARDNER. U. S. 1,642,238, Sept. 13. $Ni-NH_4$ sulfate 8 oz., Ni sulfate 4 oz., H_3BO_3 2 oz., NH_4Cl 0.03 oz., $CdCl_2$ 3 dwts., glycerol 1.5 oz. and H_2O 1 gal.

Malleable iron or steel or alloys. E. G. T. GUSTAFSSON. *Brit.* 262,126, Nov. 28, 1925. In producing malleable Fe or steel or their alloys in a closed elec. furnace, a reducing agent comprising carbonaceous material is added during the first part of the smelting in less quantity than that theoretically required for the complete reduction of ore simultaneously supplied, and a further quantity of the reducing agent is later added to bring the total above the theoretical requirement for reduction and supply the desired quantity of C in the product. The second supply of carbonaceous material is fed on to the slag bath.

Iron, steel and their alloys. E. G. T. GUSTAFSSON. *Brit.* 262,127, Nov. 28, 1925. Ore, fluxes and reducing agent are fed in a thin layer on to a slag bath in an elec. furnace and reduced by the heat developed in the slag. The ore may be partially reduced in a previous preliminary operation by gases from the elec. furnace and the reducing material which may be carbonaceous or ferro-Mn or ferro-Si may be preheated. Various details and modifications are described.

Coating metal articles. M. FOURMENT. Brit. 262,439, Dec. 5, 1925. Gear wheels or other articles are heated by elec. currents, preferably by high-frequency induced currents, to effect diffusion of coating materials such as Zn or Al. App. is described.

Electric kettle. CREDENDA CONDUITS CO., LTD., AND P. W. DAVIS. Brit. 261,805, May 25, 1925.

Electric arc furnace fed by direct current from a mercury-vapor rectifier. AKT.-GES. BROWN, ROVERI, ET CIE. Brit. 261,785, Nov. 21, 1925.

Electric arc furnace for producing metals from ores. D. CROESE. U. S. 1,642,359, Sept. 13.

Electric furnace for aluminum production, etc. NORSKE AKTIESELSKAB FOR ELEKTROKEMISK INDUSTRI. Brit. 262,722, Dec. 9, 1925.

Forming fused silica tubing in an electric furnace, etc. L. B. MILLER. Brit. 262,110, Nov. 24, 1925.

Electric glass-making furnace. J. K. B. RAEDER and AKTIESELSKAPET RAEDERS ELEKTROGLASOVN. Brit. 262,535, Sept. 17, 1925.

Magnetic slot wedges for electric apparatus. BRITISH THOMSON-HOUSTON CO., LTD., F. P. WHITAKER, R. I. MARTIN and E. E. ROBINSON. Brit. 261,816, July 27, 1925. Magnetic slot wedges are formed of laminæ of material such as cotton or asbestos, bonded with a synthetic resin or other suitable binder and with assoc. magnetic material such as powd. metal or wire between the laminæ.

Electrically heated annealing furnace. SIEMENS-SCHUCKERTWERKE GES. Brit. 262,133, Dec. 3, 1925.

Electrically heated annealing furnaces. SIEMENS-SCHUCKERTWERKE GES. Brit. 262,462-3, Dec. 5, 1925.

Electrically heated annealing furnace. C. F. KENWORTHY. Brit. 262,651, May 14, 1926.

Electrically heated bright annealing furnace. SIEMENS-SCHUCKERTWERKE GES. Brit. 262,766, Dec. 10, 1925.

Electric annealing furnace. SIEMENS-ELEKTROWARME-GES. Brit. 262,468, Dec. 5, 1925.

Electrode holder for electric furnaces. NORSKE AKTIESELSKAP FOR ELEKTROKEMISK INDUSTRI. Brit. 262,481, Dec. 7, 1925.

Electric resistance. SIEMENS & HALSKE AKT.-GES. Brit. 262,778, Dec. 8, 1925. A helical wire of Pt-Ir is used inside of a glass tube which can be turned about a horizontal axis and can be short-circuited by Hg within the tube.

Electric resistances. R. H. WINTER and H. C. DALY. Brit. 261,864, Sept. 4, 1925. Resistance units of grid leaks or the like comprise a strip of inked, coated or impregnated paper, cotton or silk. Structural details are specified.

Electric resistance material. A. DILGER. Brit. 262,164, Aug. 4, 1925. A material for use in rheostats having a contact moving over a resistance embedded in a groove may be formed of sulfides of Sn, Fe and Pb, which may be compacted under high pressure with or without an inert material such as S.

Electric incandescent lamps. NAAMLÖÖZE VENNOOTSCHAP PHILIPS' GLOEILAMPENFABRIEKEN. Brit. 262,288, Jan. 20, 1926. A small proportion of halogen vapor is mixed with N in lamp bulbs, to prevent arcking. Brit. 262,289 specifies the use of B fluoride or other salt of hydrofluoboric acid as a "getter" to lessen blackening of bulbs by deposits of W.

5—PHOTOGRAPHY

C. E. K. MEES

False data in the history of photography. J. M. EDER. *Naturwissenschaften* 15, 653-4(1927).—Historical.

Contribution to the problems of photographic gelatin. B. J. C. VAN DER HOEVEN. V. ISAJEVIC. *Kolloid-Z.* 42, 339-50(1927).—The physico-chem. properties of a no. of com. photographic gelatins were compared with the object of distinguishing the essential differences between hard and soft gelatins. The hard gelatins are stated to be of higher mol. wt., contain a lower percentage of dialyzable material, and more firmly bind the adsorbed H₂O than the soft gelatin. The viscosity of gelatin sols is regarded as being primarily a function of particle size, which, in turn, is influenced by temp., age, etc.

J. G. McNALLY.

Anomalies of exposure. LÜPPO-CRAMER. *Phot. Rund.* **64**, 259-64 (1927).—The inverse square and reciprocity laws have a marked tendency to fail in special cases. In general, a greater distance from a const. light source requires more time for equally developed densities than that calcd. from the inverse square law. L.-C. gives many examples of low-speed emulsions in which the reverse is true. C. E. MEULENDYKE

The sensitizing activity of the silver halides. A. STEIGMANN. *Phot. Ind.* **25**, 676-7 (1927).—Not only the OH-ion concn. of the gelatin, but the different Ag halides of the emulsion, influence the reactivity with the labile S of the gelatin sensitizer. AgCl is more reactive than AgBr which in turn is more reactive than bromo-iodide. The reactivities apparently parallel the soly. C. E. MEULENDYKE

Contribution to our knowledge of the latent image. J. EGGERT AND J. REITS-TÖTTER. *Z. wiss. Phot.* **24**, 350-61 (1927).—Methylene blue, present in an emulsion in the quantity of 3.5×10^{-9} g. per sq. cm. surface, or 5×10^3 mols. per AgBr grain, is sufficient to cause fog on chem. development, and a marked decrease in the sensitiveness of the plate to light exposure. If the light exposure be applied before the dye, no loss in speed is noted, although the fog is produced as before. On physical development after fixation, the results are substantially the same with regard to loss in speed, although no fog is produced. Since methylene blue affects the latent image only in its nascent state, and not after it has once been formed, it is concluded that the Ag is in a more dispersed condition during the formation of the latent image than in its final state. The Ag atoms are assumed to be capable of assembling themselves on the grains at certain preferred places detd. by external (e. g., adsorptive) influences, rather than the positions of light absorption. M. W. SEYMOUR

Reversal of film. J. HENRI-ROBERT. *Rev. franç. phot.* **8**, 233-4 (1927).—H.-R. discusses reversal of motion picture films diagrammatically, considering the upper portion of the emulsion layer as negative material and the lower portion as positive material. The reversal is of the type employing complete development of the Ag halide surviving the bleaching operation. Exact and equal conditions of exposure and precise first development are essential to successful positives. C. E. MEULENDYKE

Eliminating fog in photogravure. H. M. CARTWRIGHT AND F. J. TRITTON. *Phot. J.* **67**, 403 8 (1927).—Gelatin gravure resists developed on Cu cylinders show a slight uniform hardening (fog) due to tanning by Cu salts. The hardening destroys the true density relations particularly in the highlights. C. and T. verify the suggestion that resists developed on silvered Cu have less inherent fog, and find that etching in perchloride is hastened by the Ag, owing to elec. couple privation. Gilded Cu is even more reactive. K. C. D. HICKMAN

Ripening of silver halide emulsions. R. E. LIESEGANG. *Phot. Ind.* **25**, 885-6 (1927).—While the chem. side of ripening problems now claims the major interest, the older physical side should not be neglected. This includes the dependence of sensitivity on grain-size as connected with coagulation and Ostwald ripening. C. E. MEULENDYKE

Plate gradation and ripening germs. LÜPPO-CRAMER. *Camera (Luzern)* **6**, 39-41 (1927).—The effect of an oxidizing after-treatment on ripened emulsions has only been investigated thoroughly as regards threshold sensitivity. Expts. are described on the effect of desensitization with chromic acid on the ascending portion of the sensitivity-density curve. Different plates were bathed for 3 min. in a soln. of $K_2Cr_2O_7$ 20 g., concd. H_2SO_4 40 cc., H_2O to 1 l.; washed for 2 hrs., and dried. Each, together with the corresponding untreated plate, was given an exposure under the Goldberg wedge extending into the over-exposure portion of the curve for normal plates; all were developed for 2 min. in metol-hydroquinone. With the slower and more contrasty plates, the effect of the treatment is to produce a moderate displacement of the curve approx. parallel to itself, whereas with the faster plates the displacement is much greater and the 2 curves are less nearly parallel. With an exptl emulsion, the ripening of which was arrested at several different points, L.-C. obtains a curve confirming his previous observation that the threshold speed of a chromic acid-treated, ripened emulsion may actually be lower than that of a similarly treated but unripened emulsion. E. R. BULLOCK

Developers for hot countries. A. LUMIÈRE, L. LUMIÈRE, AND A. SEYEWETZ. *Chimie et industrie Special No.*, 458 (May, 1927).—Swelling of gelatin at 35-40° can be prevented by adding a large amt. (up to 200 g. per l.) of alkali sulfite to certain developers (e. g., metol-hydroquinone, metoquinone), or of Na_2SO_4 to others (diaminophenol); but this increases the bulk of the solid developer and prevents swelling only during developing and not during washing. Normal pyrogallie acid developers can produce permanent insolubilization during the development; but their rapid oxidation

at 35–40° gives a yellow image, which prevents their use. The same insolubilization can be obtained with most of the alk. developers by making alk. with either an alk. carbonate or an alk. hydrate, provided only a small amt. of sulfite is used (not over 1.5 g. per l. with carbonates and 3 g. with hydrates); the insolubilization is produced by the oxidation products of the developer. Owing to the rapid oxidation of most developers under these conditions, only a small no. of them can be used in practice.

A. PAPINEAU-COUTURE

Metoquinone and mixtures of génol and hydroquinone. A. LUMIÈRE AND A. SEYEWETZ. *Sci. ind. phot.* Nov. 1926, *Industrie chimique* 14, 217(1927).—In reply to an observation of Hübl, L. and S. protest against the opinion of the Agfa labs., according to which metoquinone is not a compd. of hydroquinone and génol comparable to a salt, but an addn. compd. which is split up into its constituents by soln. in H_2O or in a sulfite soln.; in metoquinone the amino radicals of 2 génol mols. seem to be esterified by 2 phenol groups of the hydroquinone mol. On cooling a boiling satd. soln. of metoquinone in water or sulfite soln. it crystallizes without change in m. p. (metoquinone m. 135°; hydroquinone m. 169°; methyl-*p*-aminophenol m. 87°). Dissocn. by water or sulfite solns. would not be incompatible with the hypothesis of an esterification, as a large no. of salts are ionized in aq. soln., and sulfites, acting as weak alkalies, liberate the base from certain salts, e. g., the hydrochlorides of *p*- $C_6H_4OHNH_2$ and of diaminophenol.

A. PAPINEAU-COUTURE

Insolubilization of gelatin on photographic plates by means of developers. A. LUMIÈRE, L. LUMIÈRE AND A. SEYEWETZ. *Chimie et industrie Special No.*, 459–62(May, 1927).—Most org. developers can insolubilize gelatin during development, in the same way as pyrogallie acid, provided the developing soln. contains but a small quantity of Na_2SO_3 , not over 2 g. per l. in presence of alk. carbonate or 4 g. per l. in presence of alk. hydrate, as compared with up to 16 g. with pyrogallie acid in presence of alk. carbonate or 6 g. with pyrocatechol in presence of alk. hydrates. The insolubilization is effected by the action of oxidation products, which Na_2SO_3 either destroys or prevents from forming. Some developers which are but slightly oxidized by air in alk. soln. (e. g., pyrocatechol, hydroquinone, metoquinone, génol-hydroquinone) can be used in presence of a very small quantity of Na_2SO_3 as substitutes for pyrogallie acid for obtaining images by removal of gelatin in hot water as in the so-called "carbon" process.

A. PAPINEAU-COUTURE

Speed of fixing. ANON. *Photo-Revue* 38, 176(1926).—The max. of rapidity of fixing is with 30% hypo, with or without boric acid. $NaHSO_3$ should be employed only when it is desired to clear the gelatin.

J. R. ELLIOTT

Red filter in the printing-out process. F. FORMSTECHE. *Phot. Ind.* 25, 885 (1927); cf. *C. A.* 20, 1038.—A Ponceau-red filter absorbs the green but transmits some blue and violet rays. A monochromatic red filter made by conjunction of Ponceau-red and filter-yellow dyed gelatin sheets was not equiv. to a gray filter of density 3.3. Four weeks of diffused daylight were required for an image on a collodion printing-out paper. The color of the image was a brownish yellow as against the normal blue to red-violet.

C. E. MENLENDYKE

Secondary colored image. J. J. HANSMA. *Photo-Revue* 39, 56(1927).—The colored residual image which remains after dissoln. of a Ag photographic image with Farmer's reducer is thought to be Ag_2S . The fact that this colored material is removed if KNC , $KMnO_4$ plus HCl , or a very concd. soln. of ferricyanide and hypo is used, is considered as proof. KCN , or a mixt. of this and $K_3Fe(CN)_6$, dissolves a Ag_2S image. $KMnO_4-HCl$ soln. converts Ag_2S to $AgCl$.

C. F. IVES

Two-color process: generalities, advantages over the three-color. R. NAMIAS. *Photo-Revue* 38, 189–92(1926).—Two negatives are made on panchromatic film taken through red-orange, and blue-green filters, resp. Positives are made and mordanted in a bath of Cu thiocyanate 40 g., Na citrate 60 g., AcOH 30 cc., NH_4CNS 20 g., H_2O 1 l. The positive made from the red-orange filter is dyed green in a soln. of malachite green 5% and AcOH 1%. The other is dyed in a soln. of rhodamine and auramine 2% and AcOH 1%. These are then washed to clear the high lights and superimposed, giving a good two-color positive.

A. D. SLACK

Theory of carbro. C. LIGHTON. *Phot. J.* 67, 362–73, 409–21(1927).—Carbro pictures from bromide prints involve the use of $K_3Fe(CN)_6$ and $K_2Cr_2O_7$. $Ag_3Fe(CN)_6$ is formed, then $AgBr$ while the $Ag_3Fe(CN)_6$ reduces the $K_2Cr_2O_7$. Carbons prepd. by this simple scheme have too high gammas, the shadows being clogged and the highlights bare. A few sec. immersion in an acid hardening bath after bleaching gives correct reproduction but uniformity cannot be secured in the necessarily short time. Attempting to compound a single bath showed that $K_2Cr_2O_7$ could be replaced

by chromic acid, within limits and gamma reduced. Loss of high light detail is generally due to slowness in squeegeeing, some $\text{Ag}_2\text{Fe}(\text{CN})_6$ produced at the moment of soln. contact being allowed to escape before true gelatin contact is secured. The action of the second or acid bath in the carbonyl process is examd.; compounded usually with a hardening substance and a dil. acid its beneficial action is due chiefly to diln. of the surface layers of ferricyanide-dichromate sensitizer in the tissue. The acid may equally well be placed in the first sensitizing bath and the hardener is best omitted. Gamma can be controlled by a second bath of dil. chromic acid and dichromate.

K. C. D. HICKMAN

Photographic spectrophotometry in the ultra-violet (JONES) 3.

Screen for color photography. L. DUFAY and SOC. ANON. COMPAGNIE D'EXPLOITATION DES PROCÉDÉS DE PHOTOGRAPHIE EN COULEURS L. DUFAY. Brit. 262,386, Dec. 4, 1925.

Photomechanical printing surfaces. E. B. ELDRIDGE and J. A. HAESLER. Brit. 262,531, Sept. 15, 1925. To obtain grainless collotype printing surfaces from Ag images, an ordinary plate or emulsion is developed with a developer, the action of which is so feeble or restricted as to produce an extremely faint and tenuous image, before being fixed and treated with the dichromate or like hardening bath. Amidol developer, dild 12-20 times from the usual strength, may be used, and a hardening bath may be formed from CuSO_4 , KBr, $\text{K}_2\text{Cr}_2\text{O}_7$ and chromic acid. The bleached Ag image may be dissolved out or left in. Various details and modifications are described.

Mixture for photosensitization. E. E. JELLEY. Dutch 16,836, Aug. 15, 1927. A soln. of an Ag salt, 4%, with a hydrazine compd (e. g., nitrate), 1%, is used to coat a surface. It gives a printing out effect.

6—INORGANIC CHEMISTRY

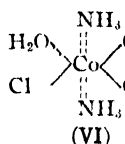
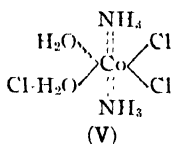
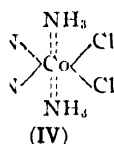
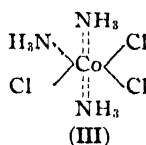
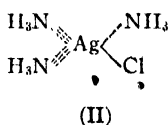
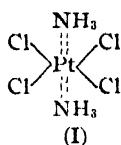
A. R. MIDDLETON

Ebullioscopic determination of some complexes. F. BOURION and E. ROUYER. *Compt. rend.* 185, 127-30 (1927); cf. *C. A.* 21, 1772.—It is shown that in solns. of $\text{KCl} + \text{CdCl}_2$ when there is an excess of CdCl_2 there is formed mainly the complex K_2CdCl_4 , but also an appreciable amount of K_2CdCl_4 . In equimol mixts. of HgCl_2 and KBr there are formed the complexes $\text{K}_2\text{HgCl}_2\text{Br}_2$ and KHgCl_2Br , the former predominating; in non-mol. mixts. there is probably present K_2HgCl_4 together with addn. products and double-decompn products. In equimol. mixts. of HgCl_2 and AcONa there is formed either the complex $2\text{AcONa} \cdot 3\text{HgCl}_2$ or a mixt of 2 complexes, one contg. more and the other less HgCl_2 than in the preceding formula. In non-equimol mixts. there is a superposition of the complex $2\text{AcONa} \cdot 3\text{HgCl}_2$ and of a complex contg. more AcONa than $\text{AcONa} \cdot \text{HgCl}_2$, but it was not found possible to det. the compn. and equil. const. of the latter because concd. AcONa and dil. HgCl_2 soln. gives progressive pptn. of a red compd. which interferes with the observations.

A. P.-C.

The structure of complex compounds. E. GAPON. *Ukrainskii Khim. Zhurnal* 1, 595-632 (1925); *Chem. Zentr.* 1926, II, 153-4.—To reduce the indefiniteness of the coordination no. of an element, the postulate is advanced that the no. of the secondary valences is equal to 8 minus the no. of primary valences, and that in complex compds. the secondary valences are always satd. If the central atom in a compd. has the coordination no. 6 or 4, it is bound to 2 mols. through double or triple bonds (I or II, resp.). The presence of multiple bonds restricts the capacity of compds. with coordination no. 6 or 4 for further addns. In addn. reactions, the displaced radical remains no longer united to the central atom, but only with the entering mol. (see III and IV). With several mols. contending for the addn., the mol. with the highest dielec. const. enters the compd., a result which is shown to be related to the Nernst-Thomson law. In complex compds. of higher order, the secondary valences of the central atom also play a part in the addn. of a mol., e. g., with the O in water and the N in NH_3 . In compds. with a coordination no. of 6, both double bond mols. lie in a plane, and the other 4 mols. or radicals in another plane at right angles to the first plane. Therefore compds. of the type: $[\text{Me}(\text{NH}_2)_2\text{X}_3]$ or $[\text{Me}(\text{NH}_2)_2\text{X}_4]$ can exist only in one stereo form, whereas 2 stereoisomeric forms are possible for compds. of the type: $[\text{Me}(\text{NH}_2)_2\text{X}_2]$. The compd. $[\text{Co}(\text{NH}_2)_2(\text{OH})_2\text{Cl}_2]\text{Cl}$ can likewise exist only

in 2 isomeric forms (V and VI), while the Werner theory foresees 5 forms. For the radicals: $\text{H}_2\text{O}=\text{---}$, $\text{H}_2\text{O}=\text{---}$, ---OH and $\text{H}_2\text{O}=\text{---}$, which the theory of G. distinguishes, the mol. vols. are 15.764, 13.512, 14.638 and 12.386, so that the differences in their modes of formation are confirmed.



C. C. DAVIS

The complex stannic and stannous iodides. TRYPHON KARANTASSIS. *Ann. chim.* 8, 71 119 (1927), cf. *C. A.* 20, 1570. K. describes the prepn. of SnI_4 and discusses equil. between SnI_4 , H_2O and HI , properties of soln. and action of the alics., Et_2O , and Me_2CO , prepn. of SnI_6 , CS_2 ; properties of SnI_6Rb_2 with action of heat and solvents, H_2O , abs. alc., anhyd. Et_2O , CHCl_3 , CS_2 and CCl_4 , properties of RbI_3 ; prepn. of $\text{SnI}_6[(\text{CH}_3)_4\text{As}]_2$, $\text{SnI}_6[(\text{C}_6\text{H}_5)_2\text{NH}_2]_{2.5}$ and 5 , $[\text{SnBr}_3]_{7.5}\text{I}_{0.75}[\text{K}]_2$, $[\text{SnBr}_3]_{3.5}\text{I}_{0.65}[(\text{NH}_4)_2]$, $[\text{SnBr}_3]_{5.1}\text{I}_{1.19}[\text{Rb}]_2$ and $\text{SnBr}_3\text{KBr}_2$ (prepn. of the iodobromostannate mixts. of Sr and Ba was tried without result), and the prepn. of $[\text{SnCl}_3]_{0.94}\text{I}_{0.06}[(\text{NH}_4)_2]$ and SnCl_3Rb_2 . An attempt to prep. a titanium iodide of Rb resulted in a residue consisting of a mixt. of RbI and $\text{Ti}(\text{OH})_3 \cdot 2\text{H}_2\text{O}$. $\text{ZrOI}_2 \cdot 8\text{H}_2\text{O}$, $\text{ThI}_3 \cdot x\text{H}_2\text{O}$, CeCl_3 and $\text{CeCl}_4[(\text{CH}_3)_4\text{As}]_2$ were prepd. The iodide of Ce does not exist. Alc. solns. of aniline-HCl and of CeCl_3 formed a ppt., but this could not be analyzed. There were prepd. complex salts of SnI_4 of the types $\text{Sn}(\text{Hal})_4\text{M} \cdot \text{H}_2\text{O}$ and $\text{Sn}(\text{Hal})_4\text{M}_2 \cdot 2\text{H}_2\text{O}$, in which Hal represents halogen and M represents K or NH_4 ; SnI_3Rb , SnI_3Rb_2 , SnI_3Cs , $\text{SnI}_3\text{N}[(\text{C}_6\text{H}_5)_4]$, $\text{SnI}_3\text{---NH}_2\text{C}_6\text{H}_5$, 2SnI_2 , CsI , and 2SnI_2 , RbI ; SnCl_2 , SnI_2 (by the direct action of I_2 on Sn in a sealed tube, the action of SnCl_2 on KI, from SnCl_2 and NaI in the presence of HCl, and the action of I_2 on Sn in the presence of HI), SnCl_4 , SnBrI , SnBr_2 and SnClBr . Points of fusion of various mixts. of SnI_2 and SnCl_2 , SnI_2 and SnBr_2 , and SnCl_2 and SnBr_2 are given. Double-decompn. reactions were found to take place between SnCl_4 and AsI_3 , BiI_3 , PI_3 and TiI_4 , SnI_4 and AsBr_3 , AsCl_3 , SbCl_3 , SbI_3 and PbCl_2 ; PI_3 and AsCl_3 , SbCl_3 , BiCl_3 , PbCl_2 , TiCl_4 and SbCl_3 , PCl_5 and TiI_4 , PCl_5 and SbI_3 . No reaction was observed between PCl_5 and AsI_3 , SbI_3 , BiI_3 , PbI_2 , SnI_4 or SiCl_4 ; PI_3 and ZrCl_4 or ThCl_4 ; SnI_4 and SiCl_4 , TiCl_4 , ZrCl_4 or ThCl_4 .

N. M. BOUDER

New series of complex compounds of tervalent iridium. V. V. I. BEDINSKII. *Ann. inst. platine* No. 4, 235-42 (1926). --L. prepares triethylenediamine iridiiodide, $[\text{Iren}_3]_3 + \text{H}_2\text{O}$, and picrate from 1 g. $\text{Na}_3[\text{IrCl}_6] + 12\text{H}_2\text{O}$ and 2 cc. ethylenediamine monohydrate in 10 cc. water by heating in a tube at 140° . This is pptd. with KI, giving yellow-rose tablets from water, mol. cond. 388.04 at 25° in 0.001 M soln. It also gives a cryst. ppt. with Na_2PtCl_6 , yellow plates, $(\text{NH}_4)_3\text{PtCl}_6$ flesh-colored, $\text{Na}_2\text{---Pt}(\text{CN})_4$ white, H_2PtBr_6 yellow prisms, Na chloroiodate greenish, Na chloroosmate yellow-green, K ferrocyanide yellow, K ferricyanide yellow-orange, NH_4CNO no ppt., K oxalate no ppt., $(\text{NH}_4)_2\text{SO}_4$ no ppt. With Na picrate there are formed canary-yellow plates, little sol. in water of $[\text{Iren}_3](\text{C}_6\text{H}_5(\text{NO}_2)_3\text{O})_3$. NaClO_4 forms no ppt.

WILLIAM M. MALISOFF

Germanium. XX. Preparation of fused germanium directly from germanium dioxide. KATHARINA M. TRESSLER AND L. M. DENNIS. *J. Phys. Chem.* 31, 1429-32 (1927). -- GeO_2 is reduced by C under a flux of NaCl. The yield of metal is about 90% and about 7% of the Ge charged is recoverable. The advantage of this method is that any amt. of the metal may be prepd. in the massive form in a short time.

RUBY K. WORNER

Chromium carbonyl. ANDRÉ JOB AND ANTOINE CASSAL. *Bull. soc. chim.* 41, 1041-6 (1927); cf. *C. A.* 20, 3404. --Chromium carbonyl has been prepared with a 22% yield by dropping a Grignard reagent in a suspension of CrCl_3 in a mixt. of ether and benzene, in a CO atm.; the optimum temp. is between 0 and 4° . $\text{Cr}(\text{CO})_6$ is purified by washing with benzene and repeated sublimations. The crystals are orthorhombic,

$d_{18} = 1.77$, insol. in C_6H_6 , Et_2O , alc., $AcOH$; little sol. in $CHCl_3$ or CCl_4 (less than 2% at room temp.). The solns. are destroyed by light. $Cr(CO)_6$ sublimes at room temp., explodes at 210° , freezes $149-50^\circ$ in a sealed tube, starts to decompose at 200° , burns with a luminous flame. When heated at 230° it yields CO and Cr; this Cr is completely passive, and only fuming HNO_3 attacks it readily. This procedure may be used for analytical purposes, but even after heating at 700° , CO is always deficient, whereas Cr is correct, providing the heating reaches 450° . The decompn. of $Cr(CO)_6$ is limited by pressure, but is not reversible on account of the passivity of the Cr liberated. The formula, the volatility and the stability of $Cr(CO)_6$ agree with the Sedgewick theory. Each of the 6 CO groups contributes 2 electrons to the outer shell of the metallic atom. Cr having already 6 outer electrons, an envelop is built which is analogous to the outer shell of Kr.

A. L. HENNE

The relationship between the complex constitution of chromium salts and their capacity of formation of metal organic derivatives. FR. HEIN, JOH. RESCHKE AND FR. PINTUS. *Ber.* 60B, 679-87 (1927).—The following general rule has been established: Only those complex derivs. of $CrCl_3$ and $CrBr_3$ (probably also CrI_3) permit the introduction of org. radicals in the place of the halogen atoms in which at least 3 halogen atoms are connected directly (*i. e.*, not ionizable) with the Cr and which do not contain any ions in the outer sphere. This corroborates the assumption that in $CrCl_3$ and $CrBr_3$ the halogen is bound directly to the Cr. Chromous salts like $CrCl_2$ or $Cr(OAc)_2$ are also capable of reacting with $PhMgBr$. This indicates their non-heteropolar nature. They are to be regarded as ψ -salts according to Hantzsch. The reactions between $PhMgBr$ and the following Cr compds. have been studied: trichloropyridine chromium, $[CrCl_3, pvr.]$, K chromic chloride, hexamine chromic chloride, $[Cr(NH_3)_6]Cl_3 + H_2O$, triethylenediamine chromic chloride, bromide and iodide, $[Cr(en)_3]Cl_3 + 3\frac{1}{2}H_2O$, hexaquo chromic chloride, $[Cr(OH)_6]Cl_3$, chloropentamine chromic chloride, $[CrCl(NH_3)_5]Cl$, *cis*-dichloro-dien chromic chloride $[CrCl_2(en)_2]Cl$, dichlorotetraquo chromic chloride hydrate, $(CrCl_2(OH_2)_4)Cl + 2H_2O$, dry $CrBr_3$ and CrF_3 , trifluorotripyridine chromium, $CrF_3, pyr.$, dry chromic sulfate, dry chromic thiocyanate, K chromithiocyanate, $K_3[Cr(SCN)_6]$, $CrCl_2$, chromous acetate.

EMIL KLARMANN

The phosgeno-aluminates of lithium, magnesium, potassium, and lead. MOLECULAR association in phosgene solutions. D. M. BIROSEL. *Proc. Iowa Acad. Sci.* 33, 174-5 (1926).—An abstract. The work of Germann and his students has definitely established that phosgene is a mother solvent for a system of acids, bases, and salts. The acids are capable of reacting with metals and bases of this system to form salts. By neutralizing phosgeno-aluminic acid with the anhyd. halides of Li, Mg, K and Pb, their respective salts are obtained. The K and Pb salts are difficult to work with because they form crusts at the end of the Faraday tubes. Li and Mg form $LiAlCl_4$ and $Mg_2Al_2Cl_6$, resp. By a study of the pressure-concn. curves, these salts have been shown to be associated. 14 mol. of the Na salt, 12 of Sr and about 70 of Ba are associated to give a single mol. That of Ba is of colloidal magnitude.

W. G. GAESSLER

Reactions of metals with dry salts at high temperatures. BERNWARD GARRE. *Metal u. Erz* 24, 230 2 (1927); cf. *C. A.* 21, 2414.—Heats of reaction and the temp. of starting the reaction are given for Mg and Al with the alkali carbonates, oxides of Fe, PbO, CuO, ZnO, CdO and FeS.

C. G. K.

The system iron chloride-water at high temperatures. ERNST STIRNEMANN. *Neues Jahrb. Mineral. Geol. Beil.-Bd.* 52A, 334-77 (1925).—The mol. wt. of the vapor at $250-300^\circ$ corresponds to the formula Fe_2Cl_6 . The sublimation and vapor pressure curves were detd. Between 270° and 410° $FeOCl$ results by the reaction of Fe_2Cl_6 with H_2O . The system $Fe_2Cl_6-FeOCl-Fe_2O_3$ was investigated.

J. F. SCHAIER

The ternary systems $KCl-LiCl-RbCl$ and $KCl-RbCl-CsCl$. HELLMUTH KEITEL. *Neues Jahrb. Mineral. Geol. Beil.-Bd.* 52A, 378-423 (1925).—The m. ps. $LiCl$ 607° , KCl 776° , $RbCl$ 722° , $CsCl$ 629° (transition temp. at 443°) were detd. The binary system $KCl-RbCl$ shows complete miscibility with a min. at 60 mol. % $RbCl$ and at a temp. of 715° . $RbCl$ and $LiCl$ form a double salt $LiCl \cdot RbCl$ (incongruent m. p.). The complete binary and ternary diagrams are given.

J. F. SCHAIER

Reduction of silver compounds in alkaline solution. WALTER FARMER AND J. B. FIRTH. *J. Chem. Soc.* 1927, 1772-80.—A soln. of 2 g. $AgNO_3$, 25 cc. H_2O , 25 cc. NH_3 (d. 0.880), and 25 cc. 3 N KOH deposited a black film on being heated to 100° and then exploded. When excess of NH_3 was avoided, the black ppt. was gradually reduced to Ag, with the evolution of an equiv. of N ; a fragment of Al, however, caused explosion. The black ppt. was found to be a mixt. of Ag_3N and Ag_2O . The original soln. did not explode when heated with Al filings, reduction occurring quantitatively in $1\frac{1}{2}$

hrs. In another case additional quantities of 2 g. of AgNO_3 in 25 cc. NH_3 and 25 cc. H_2O were added at 20-min. intervals to the original soln. undergoing reduction at 100° in the presence of Al until 8 g. of AgNO_3 had been added. Ag was pptd. to the extent of 66.94% when AgNO_3 was used as the Ag compd. and to the extent of 48.27% when AgCl was employed. Similar results were obtained when Ag activated at 900° was substituted for the Al.

DAVID DAVIDSON

Reactions of incandescent tungsten with nitrogen and with water vapor. C. J. SMITHells AND H. P. ROOKSBY. *J. Chem. Soc.* 1927, 1882-8.—The brown deposit formed on the bulbs of N-filled W lamps was shown to be WN_2 (see Langmuir, *C. A.* 7, 3717) by means of x-ray analysis as well as by the vol. of N liberated on burning in air. The analyses were carried on in specially designed app. The d of the nitride is 5 ± 0.5 g. per cc. The black deposit formed in W-filament bulbs contg. H_2O was shown by x-ray analysis to be W. Any oxide which might have been deposited (*C. A.* 15, 3424) is supposed to have been reduced by the atomic H which is formed by the contact of mol. H with incandescent W (Langmuir, *Gen. Elec. Rev.* 29, 153(1926)).

DAVID DAVIDSON

The constitution of boron compounds. Remarks on the contribution of M. Ulmann. ALFRED STOCK. *Ber.* 60B, 1039-40(1927).—Ulmann (*C. A.* 21, 3325) proposes the mol. scheme $(\text{B}^{+4}(\text{H}^{-1})_2)(\text{B}^{-3}(\text{H}^{+1})_4)$ for the simplest B hydride, B_2H_6 . Both parts of the formula are held together electrostatically, two of the H atoms being negative as in LiH . He constructs similar formulas for the remaining compds. Their chem. behavior contradicts his theory. B_2H_6 is easily hydrolyzed, while according to Ulmann the positive H atoms therein, should be more resistant to H_2O . From the theory the unstable dichloride, $(\text{BCl}_2)(\text{BH}_4)$, should be stable and NH_3 should add differently to B_2H_{10} . H_2 is not evolved by adding H_2O to $\text{B}_3\text{N}_3\text{H}_6$, whereas Ulmann expects the negative H atoms therein to be hydrolyzed with ease. He also misses peculiarities that must be exhibited in the infra red absorption spectrum of B_2H_6 , which has so decided a polar construction.

J. BALOZIAN

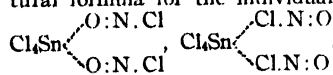
The formation of phosphorus sulfides from phosphine. LOUIS DELACHAUX. *Helv. Chim. Acta* 10, 195-7(1927).— PH_3 has been allowed to react with S for various lengths of time at different temps and pressures. The gas formed consists entirely of H_2S . The solid is a mixt. of the sulfides of P. The ratio p/T (p , pressure, T , temp.) is const. from 450° indicating that the reaction is finished at this temp. The reaction between H_2S and PH_3 was also investigated. The velocity of this reaction under 320° is practically nil. Above 320° the ratio p/T increases without, however, indicating the establishment of an equil. This reaction is considerably less rapid than the one between PH_3 and S. The resulting products are H and sulfides of P which could not be identified with any of the known, well-defined sulfides.

E. K.

Phosphate. V. Hydration of sodium metaphosphate in alkaline solution at 75° . S. J. KREIL AND H. P. COATS. *J. Am. Chem. Soc.* 49, 2180-3(1927); cf. *C. A.* 21, 1068.—The alk. hydration of metaphosphate was carried out in silver flasks, the pyrophosphate formed being detd. by the $\text{Zn}(\text{OAc})_2$ method, and the orthophosphate in the filtrate in the usual way. Pure metaphosphate was prepd. and hydrated to the di-hydrate. Solns contg. 0.1 mol. per l. NaPO_3 , and 0.5 mol. per l. NaOH ; 0.2 mol. per l. NaPO_3 and 0.5 mol. per l. NaOH ; 0.1 mol. per l. NaPO_3 and 2.0 mol. per l. NaOH ; 0.2 mol. per l. NaPO_3 and 2.0 mol. per l. NaOH , were studied. Both orthophosphate and pyrophosphate were formed in every case as end products and no equil. appeared to exist under the explt. conditions employed. Three mols. of NaPO_3 hydrated to one mol. of orthophosphate and one of pyrophosphate simultaneously. Increase in OH-ion concn. increases the rate of hydration.

J. W. SHIPLEY

Compounds of nitrosyl chloride with inorganic chlorides. HEINRICH RHEINHOLDT AND RICHARD WASSERFUHR. *Ber.* 60B, 732-7(1927).—The prepn. is carried out generally by addn. of a soln. of the metal chloride in CCl_4 to a soln. of NOCl in the same solvent, or by treating the dry metal chloride with liquid NOCl in a wide cylinder carrying a P_2O_5 tube. Further research is necessary to permit the selection of a structural formula for the individual compds. from the 2 possible ones (e. g., with Sn):



The prepn. of the following compds. is described: $\text{SbCl}_5 \cdot \text{NOCl}$; $\text{SnCl}_4 \cdot 2\text{NOCl}$; $\text{TiCl}_4 \cdot 2\text{NOCl}$; $\text{PbCl}_4 \cdot 2\text{NOCl}$; $\text{AlCl}_3 \cdot \text{NOCl}$; $\text{BiCl}_3 \cdot \text{NOCl}$ and $\text{FeCl}_3 \cdot \text{NOCl}$.

EMIL KLARMANN

The decomposition of nitrous acid in aqueous solution. T. W. J. TAYLOR, E. W. WIGNALL AND J. F. COWLEY. *J. Chem. Soc.* 1927, 1923-7.—Solns. of HNO_2 which were covered with a layer of "medicinal paraffin" were much more stable than similar

solns. under N or air. There was a crit. concn. dependent on the temp. and pressure above which the rate of decompn. was very rapid and below which it was much slower. The velocity of the slow reaction at 25° roughly agreed with the unimolecular law but the results were not significant because the rate depended on the initial concn. and the shape of the vessel. The decompn. was depressed by H_2SO_4 and Na_2SO_4 . The authors advance the view that the equilibria involved are: $2\text{HNO}_2 \rightleftharpoons \text{H}_2\text{O} + \text{N}_2\text{O}_3 \rightleftharpoons \text{NO} + \text{NO}_2$. Disturbance of the equilibria due to the insoly. of NO and the hydration of NO_2 results in the decompn. of the HNO_2 . DAVID DAVIDSON

The reaction between arsenite and permanganate in sulfuric acid solutions. TADEUSZ ORYNG. *Z. anorg. allgem. Chem.* **163**, 195-205(1927). In the absence of Na_2HPO_4 and MnSO_4 , the titration of As_2O_3 never requires more permanganate than the quantity corresponding to the passage of the Mn ion from septivalency to tervalency. The cloudiness due to the quadrivalent Mn appears only at the start of the titration; it fades immediately and never shows again. The required quantity of permanganate decreases when the acidity increases from 0.1 to 0.8 mols, but increases for higher acidities until it resumes its initial value for an acidity of 8.6 mols. In strongly acid solns. (2 mols. and more), KMnO_4 causes a red coloration which is to be attributed to the quadrivalent ion. The presence of MnSO_4 accelerates the transformation into green trivalent Mn, but requires an excess of KMnO_4 . Phosphoric acid has the same effect and besides, builds complex salts with the bivalent Mn. A. I. H.

The regeneration of molybdate residues. The specific gravity of aqueous-ammoniacal and aqueous solutions of "ordinary" ammonium molybdate. STANISLAW HOLYNSKI. *Mem. inst. natl. polonais économie rurale Pulawy* **6A**, 213-9(1925); *Chem. Zentr.* **1926**, I, 2898.—Detailed directions are given for the prepn. of $(\text{NH}_4)_2\text{MoO}_4$ from Mo residues after the detn. of H_2PO_4 . This is based on the pptn. of H_2MoO_4 by means of HNO_3 soln. in aq. NH_4OH and crystn. of $(\text{NH}_4)_2\text{MoO}_4$. Values of the d. of $(\text{NH}_4)_2\text{MoO}_4$ solns. in 0.51-6.35% NH_3 and in pure water are also given. An aq. 15% soln. has d_{18}^{19} 1.109, a 30% soln. d_{18}^{19} 1.205, and a 55% soln. d_{18}^{19} 1.375. C. C. DAVIS

The variability of valency (Ray) **2**. New process for the preparation of boron (ANDRIEUX) **4**.

7—ANALYTICAL CHEMISTRY

WILLIAM T. HALL

Review of analytical chemistry. I. Fluorescence and its applications. Ed. BAYLE, R. FABRE AND H. GEORGE. *Chimie et industrie* **17**, 179-200(1927).—A review dealing with the technic of the production of fluorescence, methods and app. used in the study of fluorescent substances, and the results obtained by the authors. **II. Method of analysis of colored gases based on the use of the photoelectric cell.** MARIE CLERGEOT. *Ibid.* 375-82.—A detailed description of the method of H. and A. Copaux (*C. A.* **20**, 1043) and its application to the detn. of dil. nitrous gases. **III. The polarizing microscope.** C. DIGAUD. *Ibid.* 554-60.—Description of the accessories required to make exams. under polarized light with ordinary types of microscopes (not mineralogical microscopes), with bibliography of 20 references. A. P.-C.

Spectrophotometry in the determination of p_H value. A. DEFORGE. *Halles aux Chais* **1927**, 229-35. H. B. MERRILL

The use of liquid amalgams in volumetric analysis. IX. Some new methods for the determination of vanadium and tungsten. KIN'ICHI SOMEYEA. *Z. anorg. allgem. Chem.* **163**, 206-13(1927).—I. *Iodometric detn. of V.*—By means of liquid Zn-Hg it is easy to reduce vanadic acid to the bivalent vanadous condition in the presence of dil. HCl or H_2SO_4 . Then, if an excess of 0.1 N I_2 soln. is added and the soln. is neutralized by adding NaHCO_3 , the V is oxidized back to the quinquevalent state in about 15 min. with frequent shaking in dispersed sunlight. The excess I_2 can be titrated with thiosulfate. **II. Titration of trivalent tungsten chloride with copper sulfate soln.**—In the presence of strong HCl , W can be reduced to the trivalent state by either Bi-Hg or Bi-Hg and the W can be oxidized back by means of 0.1 molar CuSO_4 . The end point is shown by the yellow color of the soln. exactly as in the titration of SnCl_2 with FeCl_3 . **III. Reduction of vanadic acid with Pb amalgam and subsequent titration with dichromate.**—In the presence of concd. HCl , Pb-Hg reduces vanadic acid completely to the bivalent vanadous state. Zn-Hg can also be used. Then,

on adding an excess of CuSO_4 soln. the V can be oxidized to the quadrivalent vanadyl state and the resulting cuprous chloride can be titrated with dichromate using diphenylamine as indicator. Good results are obtained if the amt. of Cu salt added, and the concn. of the HCl at each stage of the process, are properly regulated.

W. T. H.

Influence of hydrophilic colloids on the color change of indicators. A. GUTBIER AND H. BRINTZINGER. *Kolloid Z.* **41**, 16 (1927).—The effect of hydrophilic colloids on the end point, as shown by various indicators, was detd. by direct titration of 0.1 N HCl acid with 0.1 N NaOH and *vice versa*. In the cases where a difference was noticed, the deviation increased progressively with increasing amounts of colloid, and the result depended on whether the neutral point was approached from the acid or alk. side. The colloids studied were gelatin, gum arabic and dextrin, and the results obtained with the indicators were as follows: axolitmin and neutral-red underwent the color change at the normal value of p_H ; phenolphthalein and rosolic acid behaved normally in the titration of acid, but the end point was premature in the titration of alkali; alizarin behaved normally in the titration of acid, but the end point was delayed in the titration of alkali, Congo-red and methyl orange gave a premature end point in the titration of acid and a delayed end point in the titration of alkali. The use of indicators in such cases is thus very limited. Parallel expts., following the course of the titration electrometrically, showed that the presence of the colloid depresses the concn. of H ions in acid and of OH ions in alk. solns. The electrometric titration curve of HCl and NaOH in presence of 3% of gelatin or gum arabic resembles that of a weak acid and a weak base. In addition to the buffering effect of the colloid it is considered that the degree of dispersion of the indicator partly accounts for the effect. Excepting solns. of methyl orange and alk. solns. of phenolphthalein, rosolic acid, and Congo-red, the indicators were found to be colloiddally dispersed. B. C. A.

The use of cupferron in gravimetric analysis. A. PINKUS AND F. MARTIN. *Chimie et industrie Special No.*, 1827 (May, 1927).—Systematic investigation of the solubilities in H_2O , acids and bases of the ppts. of cupferron with the metals of the first 3 groups. The results are summarized in a table. The metals investigated can be divided into 5 groups: (I) practically complete pptn. even in presence of dil. strong acids, Hg^{++} , Cu, Bi, Sb⁺⁺⁺, Sn^{++} , Sn^{IV} , Fe^{++} , Fe^{+++} ; (II) practically complete pptn. in neutral soln., no pptn. in acid soln., Al; (III) partial pptn. in neutral or weakly AcOH soln., no pptn. in presence of a strong acid, Pb, Cd, Ni, Co (practically complete pptn. may be obtained, particularly with Pb or Cd, by working rapidly and with a considerable excess of reagent); (IV) partial pptn. in neutral soln., no pptn. in acid soln. (including AcOH) Ag, Hg^{++} , Cr (ppts. partially in very weakly acid solns.), Mn, Zn (with sufficient excess of cupferron it could perhaps be placed in group II); (V) no pptn., even in neutral and concd solns. As⁺⁺⁺, As^v, Sb^v. The possibilities of cupferron as a group-reagent are discussed. When using it, the following precautions should be observed: pptn. should be obtained with a sufficient excess of reagent, preferably at 0° and in concd soln., particularly with Sb, Sn, Fe and Al; when operating in presence of a strong mineral acid, use HCl or H_2SO_4 preferably to HNO_3 ; filter the ppts. rapidly, preferably with suction; for washing use cold H_2O contg. a little cupferron, acidulated (if necessary) with AcOH, HCl or H_2SO_4 , but avoid NH_4OH which frequently gives colloidal solns., particularly with Fe, Sn and Sb.

A. PAPINEAU-COUTURE

New volumetric analytical method: mercurimetry. AL. IONESCO-MATIU. *Chimie et industrie Special No.*, 1748 (May, 1927); cf. Votoček and Kašparek, C. A. 17, 1769.—I.-M. has applied V. and K's method to the detn. of Me_2CO and *alkaloids*. To det. Me_2CO : boil the Me_2CO soln. for 20 min. with 10 cc. of 50% H_2SO_4 , 10 cc. HgSO_4 (50 g. HgO dissolved in 200 g. concd H_2SO_4 and dild. to 1 l.) and 100 cc. H_2O in a 200-cc. Erlenmeyer flask provided with a reflux condenser, let cool somewhat, filter, wash repeatedly with 20 cc. H_2O , transfer the ppt. to an Erlenmeyer flask with a wash-bottle jet, add 25 cc. of 1:2 HNO_3 - H_2SO_4 mixt., warm gently to complete soln. of the ppt., destroy nitrous compds by addn. of 10% KMnO_4 to a permanent pink, transfer to a beaker contg. 100 cc. H_2O , add 12 drops of 10% Na nitroprusside and titrate with 0.1 N NaCl to disappearance of the turbidity. From the formula $\text{Hg}_2\text{SO}_4 \cdot 3\text{HgO} \cdot 4\text{Me}_2\text{CO}$, 1 cc. 0.1 N NaCl theoretically = 0.002348 g. Me_2CO ; but with the above technic 1 cc. = slightly less than 0.0028 g. probably on account of slight secondary reactions. To det. *alkaloids*: add 5 cc. of Mayer-Valzer reagent (10 g. KI and 15 g. HgI_2 per 100 cc.) to the alkaloid soln. (contg. 0.01–0.02 g. alkaloid), shake, let stand 5 min., filter, wash repeatedly with 20-cc. portions of 1% H_2SO_4 , transfer the ppt. to an Erlenmeyer flask with 10–20 cc. H_2O , add 25 cc. of 1:2 HNO_3 - H_2SO_4 mixt., warm

gently to complete soln., and proceed as for Me_2CO . By following this technic troublesome pptn. of HgI_2 is avoided. The Valzer-Mayer reagent is preferable to the ordinary Mayer, as the excess KI in the latter is liable to dissolve part of the alkaloidal ppt. The method has been applied to the detn. of quinine, morphine, strychnine, codeine and cocaine. The theoretical (assuming the ppt. to be of the type $(\text{HgI}_2)_3 \cdot \text{alk.HI}$) and practical (found by analysis of 1% solns. of pure alkaloids) equivs. of 1 cc. 0.1 N NaCl are: quinine 0.0127, 0.0066; strychnine 0.011, 0.014; morphine 0.0102, 0.0083; codeine 0.0107, 0.010; cocaine 0.0102, 0.009 g., resp. In attempting to apply the method to the detn. of albumins, complete pptn. by Tanret's, Millon's or other reagents was obtained, but it has not yet been found possible to det. the albumin equiv. of the standard NaCl, presumably on account of adsorption of Hg by the complex albumin molecules.

A. PAPINEAU COUTURE

Microchemistry and industrial analysis. R. GOUBAU. *Chimie et industrie Special No.*, 170-3 (May, 1927); cf. *C. A.* 21, 1603.—Discussion of the advantages and disadvantages of micro analysis in ordinary commercial and industrial work, with a description of the technic of the micro-detn. of Na via Blanchetière (*C. A.* 17, 3006) and of H_2O .

A. PAPINEAU COUTURE

Method of analysis for graphite packing. ALFRED E. LEEVEY. *Chemist-Analyst No.* 47, 15 (1926); *Chem. Zentr.* 1926, II, 1806.—The detns. suggested are: acetone-sol. graphite, ash and cotton. First, ext 5 g. with acetone in a Soxhlet app and weigh the residue in the thimble after drying. To det. graphite, treat the residue from the acetone extn. with ether and pour the washings into a weighed alundum crucible. Turn out the packing onto a sieve and wash with ether until all the graphite is carried away. Filter the ether through the crucible, dry and weigh. To det. cotton, either ignite the graphite-free strands and weigh or digest with concd. H_2SO_4 , pour into water, filter, wash with alc., dry and weigh.

W. T. H.

Filtration of stannic oxide. G. W. BURKE. *Chemist-Analyst No.* 47, 12-3 (1926); *Chem. Zentr.* 1926 II, 1671 2.—In the analysis of an alloy, treat 1 g. of filings with 7.5 N HNO_3 , eventually evap. to dryness. To the residue add 50 cc. of hot water and 5 cc. of concd. HNO_3 . Filter and wash.

W. T. H.

"Oxidation quotients." HELMUT MÜLLER. *Biochem. Z.* 186, 451-60 (1927).—By "oxidation quotient" is meant the ratio between N and the quantity of O_2 required for complete oxidation of the substance. To det. this the substance is digested with H_2SO_4 in the presence of KIO_3 . The O_2 used up in the reaction is measured by detg. the residual KIO_3 . The detn. is made as follows: a definite quantity of KIO_3 (200-400 mg.) is placed in a 300-500-cc. Erlenmeyer flask together with 20-30 cc. H_2SO_4 and left for 15 min. The substance or soln. to be analyzed is now added and the mixt. heated gradually to 200° on the sand bath. When no more I_2 fumes are given off the reaction is completed. The traces of dissolved I_2 are driven off by boiling. The mixt. is now transferred quant. to a 500 vol flask and dild. to vol. In 100 cc. portions the N is detd. by the Kjeldahl method of distn., while in a similar sample the KIO_3 is detd. by titration with thiosulfate, after a preliminary addn. of KI, a cc. 0.1 N $\text{Na}_2\text{S}_2\text{O}_3 = 3.567$ mg. KIO_3 .

S. MORGULIS

Sodium peroxide fusions in nickel crucibles. L. E. PITZER. *Chemist-Analyst No.* 47, 13; *Chem. Zentr.* 1926, II, 1775.—To prevent the attack of the crucible, place 20 g. of soda in the bottom and melt it over a Meker burner. Remove the crucible from the flame and give it a swirling motion so that a crust is obtained all over the sides. Then add the substance and Na_2O_2 . If during the ensuing fusion, the temp. is not raised enough to melt the Na_2CO_3 , there will not be any appreciable attack of the crucible.

W. T. H.

The accuracy of quantitative determinations of basic ions. MARY WHELAN. *Am. J. Physiol.* 76, 233 (1926).—The common methods for the detn. of the inorg. basic ions were tested in order to test the accuracy of Fiske's method for total fixed base. A plus error of 3-5% was obtained for Kramer and Tisdal's methods for Na, K and Ca, while their Mg method gave an error of plus 15%.

J. B. BROWN

The analysis of ammonium sulfite. STANLEY KETTLE. *Chemist-Analyst No.* 47, 6; *Chem. Zentr.* 1926, II, 1669.—Dissolve 5 g. of the sample in water, filter and make up to 250 cc. Titrate 20 cc. of 0.1 N I_2 solu. with the sulfite soln. to get the sulfite and thiosulfate contents. If bisulfite is present, det. in the usual way. Det. the sulfate in another portion by pptn. with BaCl_2 . In a third portion det. sulfate and sulfite by pptn. with $\text{Sr}(\text{NO}_3)_2$.

W. T. H.

Rapid method for approximate determination of sodium hydroxide in used sodium plumbate solution. H. E. KUEHN. *Chemist-Analyst No.* 47, 16; *Chem. Zentr.* 1926, II, 1670.—When Na_2PbO_2 soln. is used in the treatment of petroleum distillates, it

is often desirable to det. the NaOH of the "spent doctor." Treat a measured vol. with PbCl_2 soln., filter off the PbS and titrate the filtrate with $0.1\text{ }N\text{ H}_2\text{SO}_4$. Titrate another portion without treatment with Pb soln. In the first case the NaOH content and in the second titration the NaOH and Na_2S are obtained. W. T. H.

The determination of iodates in the presence of iodides, nitrates, nitrites and chlorides. G. LEIMBACH. *Caliche* 8, 409-11(1926).—Basing an analysis on the slow addition of neutral AgNO_3 to ppt. successively iodide, chloride, iodate and nitrite, L. added sufficient AgNO_3 to ppt. all the iodide and part of the chloride, filtered, and endeavored to remove the nitrite by acidification and boiling the filtrate, by treating with urea, by oxidizing and boiling with Cl water, or by NaOH followed by addition of iodide and titration with $\text{Na}_2\text{S}_2\text{O}_3$. The results tended to be low, as a result of decompn. of iodate in acid soln. with loss of I on boiling. Useful results are obtained by adding only a slight excess of Cl_2 or NaClO and phenol to the acid soln. The expts. were conducted in solns. contg. NaNO_3 . J. HOWARD FLINT

Determination of halogens by Volhard's method in the Chilean nitrate industry. G. LEIMBACH. *Caliche* 8, 428-30(1927).—Before back titrating the excess of AgNO_3 , L. filters off the Ag ppt. and titrates an aliquot part of the filtrate. The presence of considerable nitrate causes only slightly high results. Iodates do not interfere. J. HOWARD FLINT

Determination of sulfur in compounds containing a large amount of free sulfur. W. W. YATES. *Chemist-Analyst*. No. 47, 14. *Chem. Zentr.* 1926, II, 1669.—Treat 0.5 g. of sample together with 1 g. of quartz sand and 1 g. of pure CaCO_3 with a little water and 30-40 cc. of fuming HNO_3 . After 2 hrs. add 3 g. of KClO_3 and evap. to dryness. Bake for 30 min., take up with dil. HCl , filter if necessary and ppt. BaSO_4 in an aliquot part of the filtrate. W. T. H.

An arrangement for combustion by means of the copper oxide spiral. S. Tschirmanoff. *Z. anorg. allgem. Chem.* 162, 31(1927).—To det. CO in air it is often customary to oxidize it with yellow HgO but the same effect can be accomplished by means of a CuO spiral heated electrically. Take a 30 cm. long glass tube and cover it with a spiral of nickel wire of 0.3 mm. diam. and 5 mm. long. Solder the ends of the wire to heavier Cu wires leading to the ends of a larger combustion tube in which the smaller tube is eventually placed. Electroplate a thin coating of Cu on the nickel spiral. Then, on heating in a current of air by means of 2 amps. of current at 110 v., the superficial layer of Cu is converted into CuO which will serve for the oxidation of CO when a gas mixt. is passed through a tube contg. the red hot spiral. W. T. H.

Note on the electrolytic determination of alkali. P. DROSSBACH. *Z. anorg. allgem. Chem.* 165, 149-56(1927).—Hildebrandt's method was tested and found satisfactory but an improvement in the app. is suggested. An attempt is made to explain the reactions that take place at the cathode. W. T. H.

The potentiometric titration of molybdenum. H. BRINTZINGER AND F. OSCHATZ. *Z. anorg. allgem. Chem.* 165, 221-4(1927).—The results of much experimentation show that Mo can be reduced quantitatively from the sexivalent to tervalent state by means of CrCl_2 . The electrometric titration shows a noticeable drop in e. m. f. when the reduction to the quinquevalent state is finished and a more distinct drop when the reduction to tervalent Mo is completed but there is no noticeable change in the e. m. f. curve at the point where the reduction to quadrivalent Mo is complete. To carry out the titration it is recommended to prepare $0.1\text{ }N\text{ CrCl}_2$ by the method of Zintl and Rienäcker (*C. A.* 21, 3173), standardizing against CuSO_4 . To 20 cc. of neutral molybdate soln. add 50 cc. of concd. HCl and 50 cc. of water. Sat. the hot soln. with KCl and remove all dissolved O_2 by boiling 30 min. while passing CO_2 into CrCl_2 soln. and thence into the Mo soln. Titrate at $80\text{--}100^\circ$ with the standardized CrCl_2 soln., using as indicator electrode a Pt wire, connected with a satd. calomel cell. W. T. H.

The volumetric determination of arsenic trioxide by permanganate. OTTO PROČKE AND JOSEF ŠVĚDA. *Časopis Československého Lékařnictva* 5, 68-73(1925); *Chem. Zentr.* 1926, I, 1859.—The detn. of As_2O_3 with KMnO_4 in acid medium can be carried out very rapidly, even at room temp., if a suitable catalyzer (I^+) is used. The end point is sharp, and this method is comparable with the iodometric method. C. C. D.

The ceruleomolybdate estimation of phosphate-phosphorus. B. E. GILBERT AND J. B. SMITH. *J. Biol. Chem.* 74, 223-9(1927).—The color formation in the ceruleomolybdate estn. of PO_4^{---} (cf. Denigés, *C. A.* 17, 1974) is inhibited by acids, intensified by bases and affected by the presence of certain salts. For accurate results it is, therefore, necessary to have the same conditions of acidity and salt concn. in the com-

parison standard as in the original soln. The colored complex is destroyed by reducing agents. It is not dialyzable through collodion. A. G.

Determination of phosphoric acid. P. BOISCHOT. *Ann. sci. agron.* 1925, 199-202; *Intern. Rev. Sci. Practice Agr.* 3, 1057.—Free H_3PO_4 can be detd. in solns. contg. strong mineral acids and Ca salts by titration with alkali, methyl orange and phenolphthalein being used as indicators. Titration with methyl orange gives the quantity of alkali required to neutralize the mineral acid plus the amt. required to neutralize the first H-ion of H_3PO_4 . Titration with phenolphthalein gives the quantity of alkali required to neutralize the mineral acid plus the quantity required completely to neutralize the H_3PO_4 . K. D. JACOB

The volumetric determination of hydrazoic acid with ceric sulfate in acid solution. JEROME MARTIN. *J. Am. Chem. Soc.* 49, 2133-6(1927).—When an acid soln. of a ceric salt is added to a soln. contg. hydrazoic acid or its alk. salt, the following reaction takes place: $2\text{Ce}^{++++} + 2\text{HN}_3 = 3\text{N}_2 + 2\text{Ce}^{+++} + 2\text{H}^+$. If the reaction takes place out of contact with the air, to avoid the O_2 error, accurate results can be obtained by detg. the excess Ce iodometrically. W. T. H.

The determination of the nitric nitrogen by means of the Davis-Lunge process. A. PINKUS AND J. JACOBI. *Bull. soc. chim. Belg.* 36, 448-68(1927).—The Lunge-Davis' nitrometer method is generally used for the N detn. in nitro or nitroso compds. although it is subject to many causes of error. Among the more important ones are the formation of side products and the partial fixation of NO by Hg_2SO_4 . To show the extent of these errors, numerous nitrometric titrations were made, with pure and dry KNO_3 as a standard. The H_2SO_4 concn., the amt. of acid and the amt. of KNO_3 were varied. The NO vol. is always too small; the discrepancy increases with the quantity of KNO_3 used and with the acid concn. The results obtained with an acid concn. higher than 90% are fallacious, because NO is absorbed by stirring, and the gaseous phase sometimes disappears completely. The discrepancy per cc. of acid increases when the amt. of liquid decreases. It is always larger than the soly. of NO in the acids used. The conclusion is that the Davis-Lunge method is unfit for exact analyses. A. L. HENNE

Determination of sulfur trioxide in the presence of sulfur dioxide, together with some analyses of commercial liquid sulfur dioxide. J. R. ECKMAN. *Bur. of Standards, Ser. Papers* 22, No. 554, 277-85(1927).—A nearly satd. soln. of BaSO_3 is prepd. by leading SO_2 into BaCl_2 soln. in 0.02 N HCl. This reacts with SO_3 to form insol BaSO_4 which is filtered off and washed with O_2 -free water in an atm. of N_2 . The app. involved is somewhat complicated so that interested chemists should send 5 cents to the Supt. of Documents at Washington, D. C., for a copy of the paper. W. T. H.

Determination of carbon disulfide in emulsions. H. J. FISHER. *Ind. Eng. Chem.* 19, 1201-2(1927).—An attempt to adapt the methods of Doran and of Weiss to the analysis of CS_2 emulsions that are sold for treatment of lawns infested with the Japanese beetle showed that a modification of the Weiss method will give good results. The CS_2 is oxidized in alk. peroxide soln. and the resulting sulfate detd. as BaSO_4 . W. T. H.

Sensitive test for carbon disulfide. P. SACCARDI. *Giorn. chim. ind. applicata* 8, 315-6(1926); *Analyst* 51, 636.—When boiled with a liquid contg. as little as 1 part of CS_2 in 1,160,000, a reagent composed of a benzene soln. of lead plaster mixed with alc. KOH soln. gives a black coloration. This reaction serves for the detection in olive oil of oil which has been extd. by means of CS_2 . H. G.

The combustion of carbon monoxide and methane by cuprous oxide (Jaeger's method of analysis). EMERICH BRODY AND THEODOR MILLNER. *Z. anorg. allgem. Chem.* 164, 96-100(1927).—The irregularities observed by Terres and Mauguin (*C.* 9, 1239) in the preferential combustion of H_2 , CO and CH_4 by CuO (Jaeger, *Gasbeleucht.* 41, 764(1898)) cannot be accounted for thermodynamically and are therefore due to kinetic relationships. DAVID DAVIDSON

Influence of insoluble matter on the Marsh test. L. BARTHE AND R. MASSY. *Bull. soc. pharm. Bordeaux* 64, 66(1926); *J. pharm. chim.* 119, 30-1(1927); *Analyst* 52, 168.—Low results were obtained by the Marsh test method of detg. As when CaSO_4 was present. Probably any other insol. solid would have the same effect of preventing the complete liberation of AsH_3 . H. G.

Determination of hydrogen in mine damp. HEYER. *Kali* 21, 147-8(1927).—A review. D. THUSEN

A method for proteins. R. M. CHAPMAN. *Oil & Fat Ind.* 4, 172-4(1927).—Weigh out 2.5 g. of sample into a 500-cc. Kjeldahl flask, add 0.7 g. of HgO , a small

piece of paraffin, not over 7 g. of Na_2SO_4 , and 25 cc. of concd. H_2SO_4 . Start the digestion at a low heat, increase the temperature slowly and continue until the soln. is colorless, which should not take over 45 min. After cooling, add H_2O until the flask is $1/2$ full, then a few pieces of mossy Zn and 15 cc. of Na_2S soln. After thoroughly mixing allow 50 cc. of NaOH to run down the side of the flask, distil the NH_3 into 50 cc. of standard acid and titrate the excess acid with cochineal or methyl red as indicator.

E. SCHERUBEL

Application of spectroscopic analysis to the estimation of metallic impurities. EDMOND BAYLE AND LUCIAN AMY. *Compt. rend.* **185**, 268-70 (1927); cf. *C. A.* **20**, 1640.—The method, consisting essentially in photographing the ultra-violet spectrum of a highly condensed spark passing between 2 C electrodes, is applied to detection of traces of metals. The limit of sensitiveness by observation of de Grammont's ultimate rays (*C. A.* **1**, 2762) was found to be as follows, when using B. and A.'s technic: Au 10^{-6} , Ag 10^{-6} , Pb 10^{-10} , Cu 10^{-7} , Co 10^{-7} , Ni 5×10^{-7} , Fe 10^{-7} , Cr 10^{-8} , Mn 10^{-10} , Zn 10^{-8} g. The technic is an adaptation of Jolibois and Bonnet's method (*C. A.* **20**, 723-4), the soln. being electrolyzed at boiling temp. to deposit the impurity looked for at the end of the electrode to be used in the arc. The sensitiveness is of the same order as that of the method of Hartley and Moss (*C. A.* **7**, 303).

A. P.-C.

Analysis of lead base bearing metal. BURTON PAXTON. *Chemist-Analyst* No. **47**, 3 (1926); *Chem. Zentr.* **1926**, II, 1672-3.—Treat 1 g. of the sample with 2 g. K_2SO_4 and 15 cc. concd. H_2SO_4 . After the decompn. is complete, cool, dil. with 100 cc. of water and add 10 cc. of concd. HCl . Boil 12 mins., cool rapidly, add 200 cc. of water and titrate the Sb with 0.1 N KMnO_4 . Cool the titrated soln. and filter off the PbSO_4 . Wash with cold water, dissolve in hot NH_4OAc and titrate the Pb with molybdate. To the filtrate from the PbSO_4 ppt., add 25 cc. of concd. HCl , 4 Fe nails and enough of Sb soln. (obtained by dissolving 1 g. Sb in 20 cc. of concd. H_2SO_4 , diluting to 100 cc. with dil. HCl and adding sufficient HCl to dissolve any SbOCl that may ppt.) to dissolve all Sb (up to 0.15 g.) that may have been pptd. by the Fe. Boil 25 min., cool in CO_2 , filter and titrate the Sn with 0.1 N I_2 soln.

W. T. H.

Thermal methods for assaying gold and platinum. J. A. PINTO. *Rev. facultad cienc. quim.* **4**, 95-140 (1926).—A critical review of methods for assaying Au and Pt. A detailed account is given of the methods used by P., for which the original paper should be consulted.

B. C. A.

Determination of the purity of metallic boron. J. W. ANDREWS. *Chemist-Analyst* No. **47**, 16 (1926); *Chem. Zentr.* **1926**, II, 1669-70.—Fuse with NaOH-KNO_3 mixt. in a covered Ag crucible. Make slightly acid with HCl and boil off CO_2 under reduced pressure. Neutralize with *p*-nitrophenol as indicator, add mannitol and titrate the H_3BO_3 with phenolphthalein as indicator in the usual way.

W. T. H.

Confirmatory test for aluminum. J. W. ALLARDYCE. *J. Am. Chem. Soc.* **49**, 1991 (1927).—A modification of the test proposed by Attack, which depends on the adsorption color with alizarin, is given. After washing the original ppt. of $\text{Al}(\text{OH})_3$, it is dissolved in dil. HCl and repptd. with a slight excess of NH_4OH . Then, without filtering, 1 drop of satd. alizarin soln. in concd. AcOH is added. A pink coloration is obtained which soon settles out.

W. T. H.

Spectrographic detection and determination of impurities in aluminum and its alloys. R. ADAN. *Chimie et industrie Special No.*, 193-6 (May, 1927); cf. *C. A.* **21**, 1439.—Traces of impurities can be detected and estd. quant. by comparing spectrographs obtained by means of a quartz-prism spectroscope with spectrographs of 99.99% Al to which has been added known amts. of impurities. De Grammont's method and comparison of the ultimate spectral rays (*C. A.* **1**, 2762; **3**, 2900) are particularly useful for the purpose.

A. PAPINEAU-COUTURE

Rapid method for determining copper in copper concentrates. S. V. CROMPTON. *Chemist-Analyst* No. **47**, 4 (1926); *Chem. Zentr.* **1926**, II, 1671.—Treat 0.25 g. of ore with as little aqua regia as will decomp. it sufficiently. Dil. with 25 cc. of water and add enough NH_4OH to cause partial pptn. of the Fe. Add 3 cc. of AcOH and 2 g. of NaF . Shake until all $\text{Fe}(\text{OH})_3$ is dissolved. Continue as in the usual iodometric method.

W. T. H.

Determination of nickel by precipitation as hydrated oxide. B. SETLIK. *Chimie et industrie Special No.*, 188 (May, 1927); cf. *C. A.* **20**, 349.—Sufficiently accurate results for industrial purposes and works' control are obtained by adding excess NH_4OH , filtering, boiling till pptn. of $\text{Ni}(\text{OH})_2$ is complete, filtering, igniting and weighing as NiO . Analysis of pure $\text{NiSO}_4 \cdot 7\text{H}_2\text{O}$ gave 19.77% Ni (theoretical 20.10%); of $\text{NiSO}_4 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$, 14.35% (theoretical 14.89%); of Ni-plating salts contg. NiSO_4 , MgSO_4 , Na_2SO_4 , NH_4Cl and boric acid, 15.62% (15.72% by electrolysis).

A. P.-C.

Phosphorus and silicon in ferro-phosphors. L. E. PRITZER. *Chemist-Analyst* No. 47, 8(1926); *Chem. Zentr.* 1926, II, 1670-1.—Treat 0.25 g. of sample with 35 cc. of 60% HClO_4 , heating until the sample is all decompd. Cool, make slightly ammoniacal and add a slight excess of concd. HNO_3 . Dil. to 75 cc. and ppt. with molybdate in the usual manner. For the Si detn., treatment with HClO_4 instead of HNO_3 and H_2SO_4 is also advantageous. W. T. H.

Determination of small amounts of magnesium in the presence of excess ammonium salts, with special reference to the determination of magnesium in portland cements. O. KALLAUNER, J. SIMANE AND B. IIELAN. *Trans. Ceram. Soc. (Eng.)* 26, 86-8(1927).—The removal of NH_4 salts or addn. of a known amt. of Mg is recommended when considerable NH_4 salt is present. H. F. K.

A new specific color reaction of magnesium and a simple colorimetric method for the determination of traces of this element. I. M. KOLTHOFF. *Biochem. Z.* 185, 344 8(1927).—See C. A. 21, 2632. S. MORGULIS

Determination of lead in manganese bronze. F. B. DIANA. *Chemist-Analyst* No. 47, 6-7(1927); *Chem. Zentr.* 1926, II, 1672.—To avoid the pptn. of SnO_2 when Pb is to be detd. electrolytically as PbO_2 in HNO_3 soln., treat the alloy with 3 cc. of satd. $\text{Fe}(\text{NO}_3)_3$ soln. and then with 25 cc. of HNO_3 . Boil off the excess acid, dil. to about 150 cc. and electrolyze. W. T. H.

New researches on selenium. PIETRO FALCIOLA. *Ann. chim. applicata* 17, 357-8(1927).—None of the known reducing agents for Se compds. is satisfactory in the presence of HCl and many ions. Thiocarbamide, however, is an excellent reagent, and almost instantly liberates Se as a red powder from HCl solns., even when only traces are present. The test may well be made by moistening with the soln. filter paper impregnated with thiocarbamide, whereby an orange-red deposit appears. There are very few substances which inhibit the test, but Cu in large quantities forms an insol. compd. with thiocarbamide, and the NO_3 anion must be removed by extn. with benzene, AcOEt , Et_2O , etc. Solns. of free H_2SeO_3 deposit Se only partially when H^+ ions are deficient, and if the reaction mixt. is allowed to stand, filtered and a little NH_4OH added, the soln. acquires a lilac or violet fluorescent turbidity, from which Se is ultimately deposited. Colloidal Se is probably formed. If an ammoniacal soln. contg. a Se compd. is acidified with AcOH and dild., the deposit is first yellow, but changes to orange-red. This renders the thiocarbamide test uncertain in alk. solns. To sep. Se from Te, the soln. is dild., acidified with HCl, thiocarbamide is added until all Se is pptd. and the soln. becomes yellow, the latter is immediately filtered and the Se washed with EtOH , dried and weighed. This method is as accurate as the SO_2 method. C. C. DAVIS

A reaction of tellurium. PIETRO FALCIOLA. *Ann. chim. applicata* 17, 359 60 (1927); cf. preceding abstr.—Unlike Se, Te is not liberated from soln. by thiocarbamide, and this applies to dil., concd., acid and neutral solns. When the soln. is concd., a yellow cryst. compd. is pptd. which is insol. in ordinary org. solvents, except EtOH . The reaction is very sensitive and the soln. turns yellow with 1 part of Te per 500,000 of soln. This test may also be made on filter paper (cf. preceding abstr.), though Bi and Sb give somewhat similar colors. The yellow compd. contains Te, Cl, C, N and S, and m. 165° (turning brown). It hydrolyzes when washed with water, becoming green, but it is stable after washing with $\text{EtOH-Et}_2\text{O}$ mixt. Its compn. was not detd. If the yellow reaction mixt. is shaken with Et_2O and K xanthate, the Et_2O layer acquires a mahogany-red color with subsequent sepn. of a blackish ppt., the aq. soln. becoming colorless. Se gives no coloration. If Mo is present, it may color the Et_2O layer and mask the color of the Te, but the addn. of NH_3 decolorizes this and gives a blackish turbidity or ppt. with Te. By repeated extn. with Et_2O contg. K xanthate, it is possible to effect a quant. sepn. of Te from soln. Evapn. of the Et_2O leaves a lustrous ruby-red cryst. hygroscopic substance, with disagreeable odor, and which decomp. when warmed. Its compn. was not detd. C. C. DAVIS

Electrolytic determination of zinc from solutions which are acid with sulfuric acid R. BELASIO AND E. MELLANA. *Ann. chim. applicata* 17, 336-46(1927).—The method is the first one by which a quant. deposition of Zn can be obtained from solns. contg. mineral acids. The Zn is deposited as a compact, cryst., adherent grayish white mass with no evidence of sponginess and contg. no Pb. Systematic expts. led to the choice of the following most favorable conditions. Chlorides and nitrates should not be present. Add excess NaOH or NH_4OH to the soln. (which may contain up to 1 g. of Zn in the form of ZnSO_4), make acid (to Me orange) with $N \text{ H}_2\text{SO}_4$, dil. to 250-300 cc. and electrolyze at room temp., using a Winkler coppered cathode or better, a Winkler brass amalgam cathode, and a cylindrical Pt gauze anode covered with

PbO₂. With a c. d. of 0.1–0.2 amp. and rotating the anode slowly, 10 or more g. of PbO₂ can be deposited in compact, adherent form on the Pt from a satd. Pb(NO₃)₂ soln. Begin the electrolysis of the Zn soln. with 0.4–0.5 amps. and after 3–4 hrs. increase to 0.7 amps. When 1 cc. of electrolyte gives no turbidity with 1 drop of aq. K₄Fe(CN)₆ after 10–15 min., the deposition of Zn is complete (5–6 hrs.). Replace, without interrupting the current, the electrolyte with water, and after 5–10 min. remove the cathode, wash it with water, EtOH and Et₂O, dry at 70–80°, cool and weigh. The method is applicable to brass, crude Zn, Zn ores, etc., after other metals have been removed and the Zn has been converted into ZnSO₄ soln. C. C. DAVIS

Diphenylamine as a qualitative reagent for zinc. W. H. CONE AND L. C. CADY. *J. Am. Chem. Soc.* **49**, 2214–5(1927); cf. *C. A.* **21**, 872.—In the analysis of the Fe and Al group in qual. analysis, a soln. is obtained contg. possibly Zn and Cr. Test one part of this soln. for Zn by making acid with AcOH and adding 5 drops of a 1% soln. of diphenylamine dissolved in glacial AcOH and 5 cc. of 0.5% K₄Fe(CN)₆ soln. The immediate appearance of a dark brown, green or purplish black turbidity indicates the presence of Zn. The amt. of Zn present can be estd. by the depth of color. W. T. H.

Method for determining chromium in pig iron. H. J. MILLER. *Chemist-Analyst* No. **47**, 4(1926); *Chem. Zentr.* **1926**, 11, 1671.—Directions are given for carrying out the NaBiO₃ method. The sample is dissolved in dil. HNO₃, the insol. residue fused with soda and niter, and the Mn is pptd. as MnO₂ when the Cr is oxidized to CrO₄ by bismuthate. W. T. H.

Thioglycolic acid as a color test for iron. EDWARD LYONS. *J. Am. Chem. Soc.* **49**, 1916–20(1927).—It has been known for a long time that a characteristic coloration is produced by the action of thioglycolic acid upon an Fe salt in neutral or slightly alk. soln., but the color has generally been attributed to the formation of ferric thioglycolate. It now appears that the red coloration is really due to the formation of the corresponding ferrous salt. The test, however, is independent of the original state of oxidation of the Fe because the reagent itself accomplishes reduction. To carry out the test treat 5 cc. of the neutral or slightly alk. soln. with 1 drop of thioglycolic acid and 5 cc. of concd. NH₄OH. If Fe is present in the ferric state a transient blue coloration is produced which soon changes to an intense red. W. T. H.

The precipitation of calcium oxalate in the presence of large amounts of ammonium salts. JOSEPH GROSS. *Chemist-Analyst* No. **47**, 8(1926); *Chem. Zentr.* **1926**, 11, 1670.—It is recommended to place the reagent in a beaker together with a little of the soln. to be analyzed. After a cryst. ppt. has formed, the rest of the soln. is added and the mixt. is heated 2 hrs. W. T. H.

Salts of cadmium- or bismuth-hydrohalogen acids with organic bases and their analytical use. RICHARD BERG AND OTTO WURM. *Ber.* **60B**, 1664–71(1927).—To det. Cd, when present alone, mix the neutral Cd soln. with 50 cc. of 2 N H₂SO₄ and 50 cc. of 10% Na tartrate soln. Add a slight excess of 2.5% naphthoquinoline in 0.5 N H₂SO₄ and a little H₂SO₄, making the total vol. about 150 cc. Add a slight excess of 0.2 N KI and after 15–20 min. filter off the ppt. of (C₁₀H₇N)₂.H₂(CdI₄). Wash the partially dried ppt. with a dil. soln. of naphthoquinoline, H₂SO₄ and KI. Heat the ppt. with 20 cc. of 2 N NaOH to decompose it, make slightly acid and titrate the Cd by the cyanide method. To sep. Cd and Zn, ppt. the Cd as above and titrate the Zn with ferrocyanide in the filtrate. The presence of the tartrate and iodide prevents the pptn. of Sn or Sb with Cd. To det. Bi, treat the soln. contg. H₂SO₄ or HNO₃ with an excess of 5% o-hydroxyquinoline soln. in 0.2 N H₂SO₄ and 0.1 N KI. Filter promptly and wash the ppt. with a soln. contg. 50 cc. of 2 N H₂SO₄, 25 cc. of 0.1 N KI, 18 g. of o-hydroxyquinoline and a few crystals of hydrazine sulfate in each l. After washing dry the ppt., dissolve it in HCl and titrate with KIO₃. The sepn. of Bi from Cu by this procedure requires the presence of pyridine and the sepn. of Bi from Sb or Sn requires considerable tartaric acid. A. L. HENNE

The determination of benzoic acid. O. NOETZEL. *Z. Untersuch. Lebensm.* **53**, 383–7(1927).—Detailed directions are given for the detn. of benzoic acid in ground meat, fat, wine, etc. WILLIAM J. HUSA

The analytical determination of higher alcohols, especially of hydrogenated phenols in mixtures of organic solvents, especially hydrogenated naphthalenes. II. Determination of methylhexalin in tetralin. K. LINDNER AND J. ZICKERMANN. *Chem. Umschau Fette, Oel, Wachse Harze* **34**, 199–205(1927).—Oxidation and acetylation fail to separate sharply hydrophenols from mixts., because technical methylhexalin is a mixt. of 3 isomeric hydrocresols and contains ketones and acid condensation products as impurities. L. and Z. worked out a method for detg. methylhexalin based on its (slight) soly. in H₂O, tetralin being insol. The mean soly. in 300 g. H₂O is 4.163 g.

out of 15 g. tech. methylhexalin; tech. tetralin has a very slight soly. and must first be steam-distd. to make it entirely insol. Detns. of the soly. in water of methylhexalin-tetralin mixts. ranging from 0.5 to 100% methylhexalin led on plotting to Freundlich's adsorption equation $Y^n = K \cdot x$, in which Y = methylhexalin dissolved in H_2O on the basis of the methylhexalin-tetralin mixt., x = total % methylhexalin in the methylhexalin-tetralin mixt., n and K are consts.; $n = 1.30$ and $K = 0.76$. **Method.**—A known amt. of the mixt. is steam distd., the methylhexalin in the H_2O is shaken out with ether and weighed after evapg. the ether. The oily distillate is dried with anhyd. Na_2SO_4 and 15 g. of it are shaken in a shaking app. with 20 vols. H_2O (300 cc.) for $1\frac{1}{2}$ hr. at $15-18^\circ$. The H_2O soln. is filtered off, 250 cc. of the filtrate is shaken 3 times with ether, the ether soln. is dried with Na_2SO_4 , evapd., weighed as methylhexalin and calcd. back to 300 cc. H_2O , representing 15 g. of the mixt. This value (a) is related to Y in the exponential equation as follows: $(a) =$

$Y \cdot \frac{15}{100}$ and the % of methylhexalin (X) in the mixt. is then: $\log X = 1.30 \log (a) + 1.1902$. By adding to this result the amt. of methylhexalin found by steam distn., the % methylhexalin in the original mixt. can be calcd.

P. ESCHER

Determination of isopropyl alcohol in the presence of acetone, and of methylethyl ketone in the presence of secondary butyl alcohol. H. A. CASSAR. *Ind. Eng. Chem.* 19, 1061-2(1927).—Isopropyl alc. can be oxidized to acetone by chromic acid and the excess of the latter detd. iodometrically. A similar method under different concns. can be applied to the detn. of secondary butyl alc. in the presence of methylethyl ketone. The last-mentioned compd. can be detd. iodometrically if a correction is applied for a const. error which is probably caused by the fact that 2 oxidation reactions take place simultaneously.

W. T. H.

The determination of isopropyl alcohol in the presence of ethyl alcohol. O. NORTZEL. *Z. Untersuch. Lebensm.* 53, 388-91(1927).—An accurate method for detg. isopropyl alc. in presence of EtOH is based on oxidation with $K_2Cr_2O_7$ and H_2SO_4 , the resulting acetone being detd. by titration with alkali after addn. of hydroxylamine.

WILLIAM J. HUSA

Method for the determination of the methoxyl content of volatile substances in dilute aqueous solutions in the presence of aldehydes. KARL WIESLER. *Z. angew. Chem.* 40, 975(1927).—Zeisel's method is not applicable in its original form for the detn. of methoxyl in the presence of formaldehyde or acetaldehyde. A simple change in the app. is suggested to overcome the difficulty. Before the substance comes in contact with the III the aldehyde is oxidized with moist Ag_2O . For this purpose a slight excess of $AgNO_3$ soln. is treated with NaOH and the ppt. filtered off onto a paper filter and washed with water. With the aid of a little water the ppt. is removed from the paper and transferred to the small flask. Then the soln. to be tested is added and the flask is stoppered and connected with a CO_2 generator on one side and with the decompn. flask of the Zeisel app. on the other side. The decompn. flask contains 10 cc. of HI, d. 1.96. An upright gas delivery tube from the decompn. flask runs into a reservoir contg. red P suspended in water and from thence the gas escapes into a measured vol. of standard $AgNO_3$ soln. A slow current of CO_2 is passed through the app. The decompn. flask is heated in a water bath and the flask contg. the original soln. is heated with a free flame. The analysis is finished in the usual way.

W. T. H.

Critical study of methods of analysis of antipyrine and pyrimidone. A. BORLOZ. *Helv. Chim. Acta* 10, 543-8(1927).—From the results obtained, it is clear that antipyrine can be detd. accurately by the iodometric method of Bougault (*C. A.* 11, 2386) or of Kolthoff (*C. A.* 17, 1689) but there does not appear to exist an equally good method for the detn. of pyrimidone. If a mixt. of the 2 substances is present contg. small quantities of antipyrine, det. the latter by the method of Patein (*J. pharm. chim.* 22, 5(1905)). Ext. the pyrimidone with $CHCl_3$ in the filtered soln. and det. it by the method of Pégurier (*Ann. chim. anal. chim. appl.* 10, 392(1905)). If the mixt. contains considerable antipyrine, proceed in accordance with the methods of Pégurier and Lemaire but use 2 samples for the analysis. With the first sample det. the pyrimidone by titration. Treat the second sample with an excess of picric acid and titrate the excess.

W. T. H.

Note on the determination of diacetyl and acetyl methylcarbinol. C. B. VAN NIEL. *Biochem. Z.* 187, 472-8(1927).—Diacetyl is detd. by slowly distg. the slightly acidified liquid, the distillate being collected into a mixt. of 2 cc. 20% of $NH_4OH.HCl$, 3-5 cc. 20% $AcONa$ and 1-2 cc. 10% $NaCl$ soln., which is sufficient for 100 mg. of substance. When about $\frac{1}{2}$ of the fluid has distd. over, the flask contg. the distillate is closed and

heated for 1 hr. at 80° on a water bath. The ppt. is then collected on a weighed filter, and after thorough washing with hot water it is dried at 110°. Wt. of ppt. \times 0.596 = wt. of diacetyl. Acetyl-methylcarbinol is detd. in the same way except that an excess of FeCl_3 is added to the liquid prior to distn. Wt. of ppt. \times 0.61 = wt. of acetyl-methylcarbinol. In case the detn. is to be made on a mixt. of these 2 substances, the analysis is carried out separately with and without the addn. of FeCl_3 , and each substance is detd. from the difference. S. MORGULIS

The volumetric estimation of hydroxyl groups in sugars and other organic compounds. V. L. PETERSON AND E. S. WEST. *J. Biol. Chem.* 74, 379-83 (1927).—Place 0.1 to 0.8 g. of the substance in a Pyrex test-tube 16 \times 150 mm. Add 3 to 5 cc. of a mixt. of 1 vol. Ac_2O and 2 vols. of pyridine. After acetylation is complete (24 to 48 hrs. at 60-80°) mix the product with 200 cc. of ice water and titrate to phenolphthalein with 0.5 cc. NaOH. A blank detn. is necessary. Results are given of detns. on a variety of sugars, sugar derivs., hydroquinone, benzoïn, resorcinol and β -naphthol. ARTHUR GROLLMAN

"Active" iron (Simon, Kötschau) 2. The determination of iodates and sulfates and its application to the estimation of total base in blood serum (VAN SLYKE, *et al.*) 11B. The occurrence of I in Fe and Fe slags (LUNDÉ, FELLEBERG) 9.

NOYES, ARTHUR A., AND BRAY, WILLIAM C.: A System of Qualitative Analysis for the Rare Elements. New York: The Macmillan Co.

WADSWORTH, AUGUSTUS B.: Standard Methods of the Division of Laboratories and Research of the New York State Department of Health. Baltimore, U. S. A.: The Williams & Wilkins Co. 646 pp. \$7.50.

8—MINERALOGICAL AND GEOLOGICAL CHEMISTRY

EDGAR T. WHERRY AND J. F. SCHAIER

The occurrence of covellite and chalcocite in the Mansfeld copper deposits. WERNER HOFFMANN. *Neues Jahrb. Mineral. Geol. Beil.-Bd.* 52A, 157-69 (1925).—Digenite and carmenite are undoubtedly mixts. of chalcocite and covellite and not mineral species. An analysis of Cu ore from Mansfeld is given. J. F. SCHAIER

Iron sulfide pseudomorphs of plant structures in coal. G. M. SCHWARTZ. *J. Geology* 35, 375-7 (1927).—Rounded concretionary masses of sulfide, mainly pyrite, taken from the Illinois coal field showed, when sections were polished, well-preserved plant structures of various types. W. F. HUNT

Optical anomalies of calcite under pressure. S. NISHIO. *Proc. Imp. Acad. (Japan)* 2, 395-7 (1926); *Brit. Chem. Abstracts* 1927A, 188.—From a knowledge of the optical anomalies shown by a specimen of calcite, it is possible to discuss its geol. history. C. J. WEST

The thermal dissociation of magnesium carbonate and dolomite. W. EITEL. *Neues Jahrb. Mineral. Geol. Beil.-Bd.* 51, 477-93 (1925).—The data of Mauchot and Lorenz (*C. A.* 18, 1795) and Marc and Simek (*C. A.* 7, 3090) are discussed. Analysis of the methods employed indicates the work of the latter to be the more reliable. J. F. SCHAIER

Chemical composition of crocidolite or Cape Blue asbestos. C. J. N. JOURDAN. *J. Chem. Met. Mining Soc. S. Africa* 27, 287-90 (1927).—Many samples were arranged in 8 groups according to color and phys. similarity, and a typical sample from each group was analyzed. There is no evidence that the chem. compn. has any bearing on the spinning properties of the fiber. With one exception the compns. of the samples analyzed were in close agreement although they differed markedly in color and were from widely sepd. localities. L. W. RIGGS

Olivine from Önundarfjord, N. W. Islands—A contribution to the knowledge of the olivine group. E. ERNST. *Neues Jahrb. Mineral. Geol. Beil.-Bd.* 52A, 113-56 (1925).—From the available data on olivine, forsterite, fayalite and hortonolite, the relation between chem. compn. and optical properties is derived and presented by means of tables. J. F. SCHAIER

New minerals of the mosandrite group from the Chibine Mountains. E. M. BONSHTEDT, K. A. NENADKEVICH AND I. D. STARUINKEVICH-BORNEMAN. *Bull. acad. Sci. Leningrad* 1926, [vi], 1181-98.—To 2 yellow, greenish yellow, or brownish yellow minerals of the mosandrite group, with a pale yellow streak the names *rinkolite* and

lovtchorrite are given. Their hardness is about 5 and they melt readily in the blow-pipe flame and are easily dissolved by acids. Rinkolite, $d_4^{17.6}$ 3.40, has a vitreous cleavage surface with a fatty fracture, and lovtchorrite, d 3.32, a fatty luster. The percentage compns. of the 2 are:

	SiO ₂	TiO ₂	ZrO ₂	ThO ₂	CeO ₂	Ca ₂ O ₂ (DiLa) ₂ O ₂ , Y ₂ O ₃	
Rinkolite	27.58	11.15	0.35	18.02	
Lovtchorrite	27.61	12.71	0.20	0.23	8.79	5.15	1.36
	Al ₂ O ₃	Fe ₂ O ₃	MnO	CaO	SrO	BaO	MgO
Rinkolite	1.47	0.99	trace	24.70	3.30	trace	trace
Lovtchorrite	0.13	..	0.53	27.26	3.56	...	0.80
	Na ₂ O	K ₂ O	H ₂ O	F	—O for F	Total	
Rinkolite	6.73	0.16	1.75	5.99	2.47	99.72	
Lovtchorrite	7.18	0.28	0.51	6.38	2.68	100.00	

No crystallographic measurements were possible.

B. C. A.

Detection and analysis of secondary uranium minerals. ALFRED SCHÖPF. *Chimic et industrie Special No.*, 179-81(May, 1927).—The technic of the detn. of U in its acid-sol. minerals and the identification of secondary U minerals by the Becke method are outlined.

A. PAPINEAU-COUTURE

The relations between the chemical composition and physical and optical properties of the mica group. W. KUNITZ. *Neues Jahrb. Mineral. Geol. Beil.-Bd.* 50, 365-413 (1924).—Eleven new samples of muscovite, 12 of Mg-Fe-mica and 8 of Li-Fe-mica were analyzed and the phys. and optical properties detd. on the analyzed material. The following pairs are isomorphous in the mica group: OH, F; K, Na, Si, Ti. J. F. S.

A study of glauconite. HYRUM SCHNEIDER. *J. Geology* 35, 289-310(1927).—Chem. analyses of purified samples taken from widely sepd. localities indicate the formula $KMgFe_3Si_6O_{18} \cdot 3H_2O$. The Fe content varies from 16 to 30% and alumina from 2 to 10%. Glauconite is optically—and biaxial with a small optic angle, the *ns*, and birefringence varying with the Fe content. X-ray patterns show that it is a definite mineral and not a mixt.

W. F. HUNT

The chemical composition of minerals which contain oxides of the quadrivalent and pentavalent elements. B. GOSSNER. *Neues Jahrb. Mineral. Geol. Beil.-Bd.* 52A, 265-85(1925).—G. discusses the compns. of chalcamprite, polymignite, euxenite-polycrase, blomstrandine-priorite and lewisite from the viewpoint of isomorphous replacements.

J. F. SCHAIKER

Vanadium compounds and the new mineral usbekite from the radioactive deposit in Ferghana. IVAN KURBATOFF. *Centr. Mineral. Geol.* 1926A, 345-53.—Many unusual U and V minerals occur in this region, especially at Tyuya-Muyun. The notable ones are alaite, $V_2O_5 \cdot H_2O$, turanite, $5CuO \cdot V_2O_5 \cdot 2H_2O$, and tangeite, $2CuO \cdot 2CaO \cdot V_2O_5 \cdot H_2O$. Analyses are given of colloidal mixts. of these, and efforts made to calc. the mineral compns. At Kara-Chagir there occurs a green finely cryst. mineral which gave on analysis: CuO 44.69, NiO 0.90, CaO 0.31, MgO trace, $Al_2O_3 + Fe_2O_3$ 1.40, V_2O_5 37.71, SiO_2 1.17, $H_2O - 0.53$, $H_2O + 12.82$, sum 99.53%, corresponding to $3CuO \cdot V_2O_5 \cdot 3H_2O$. This is called usbekite by Fersman. The origin of the difference in compn. of related minerals at the 2 localities is briefly discussed.

E. T. WHERRY

The occurrence of the rare mineral nadorite in Cornwall, and of beraunite in Co. Cork, Ireland. ARTHUR RUSSELL. *Mineralog. Mag.* 21, 272-5(1927).—Nadorite ($PbClSbO_2$) was found in a small Sb mine at St. Endellion, Cornwall, in a cavity of jamesonite assoc. with bindheimite, anglesite, siderite, limonite and quartz. It is orthorhombic, optically +, with strong birefringence, optic plane (010) and Bx_0 (—) \perp (100). Beraunite (hydrated Fe⁺⁺ phosphate) was found on the dump of an Fe-Mn mine in Co. Cork. The fibers are strongly pleochroic, red brown lengthwise and yellow crosswise; $n = 1.78$; sp. gr. = 2.99.

W. F. HUNT

The Natas mine in Southwest Africa, a pegmatitic-pneumatolytic-hydrothermal deposit with scheelite, molybdenite, copper ores and gold. E. REUNING. *Neues Jahrb. Mineral. Geol. Beil.-Bd.* 52A, 192-264(1925).—Geological. An analysis of scheelite is included.

J. F. SCHAIKER

Composition and structure of meteoric iron of Tametit. A. LACROIX. *Compt. rend.* 185, 313-7(1927).—The microscopic structure is described. Analysis by Raoult gave: Fe 91.13, Ni 8.39, Co 0.38, Mn 0.07, P 0.23, S 0.01, C 0.06, Si traces, sum 100.25%;

W, Mo and Cr were absent. The melting of the meteorite by means of the oxy-acetylene blowpipe raised a no. of questions as to origin of structures which are discussed at length.

L. W. RIGGS

Italian resources in ferriferous ores. GAETANO CASTELLI. *Rass. min. met. chim.* 66, 121-5(1927).—A general survey.

C. C. DAVIS

The Gonderbach lead deposits near Laasphe and their origin. ERNST KOLBE. *Neues Jahrb. Mineral. Geol. Beil.-Bd.* 52A, 286-331(1925).—The high-grade Pb-Ag ores are described. The relation of galena to sphalerite with H₂O and H₂S was studied experimentally, but few conclusive results were obtained.

J. F. SCHAIRER

Geology of the country around Ipswich, England. P. G. H. BOSWELL. *Dept. Sci. Ind. Research Geol. Survey Gt. Britain Sheet No.* 207, 121 pp.(1927).—The deposits of this region are used for making cement and bricks. Phosphate deposits were formerly worked for fertilizer, but the percentage of P is too low for profitable investment. The chalk deposits are used both as CaCO₃ and CaO in agriculture.

L. W. RIGGS

Fertilizer deposits of South Africa. A. J. PELLING. *J. Chem. Met. Mining Soc. S. Africa* 27, 277-87(1927).—A few of the deposits contain a proportion of P that should make them available for manuf. fertilizers.

L. W. RIGGS

Abrasives. I. Siliceous abrasives. V. L. FARDLEY-WILMOT. *Can. Dept. Mines, Mines Branch, No.* 673, 113 pp. 14 plates(1927); cf. *C. A.* 21, 2860.—The occurrence, quarrying and prepn. for market of grindstones, pulpstones, millstones, sharpening stones, sandstones and sand for blasting, tripoli, amorphous silica, pumice, volcanic dust and pumicite, and non-siliceous soft abrasives are described with special reference to Canadian production. World production and trade in these abrasives are reviewed. Many chem. analyses are quoted.

L. W. RIGGS

Determination of the mineral association in eruptive rocks. E. LEHMANN. *Neues Jahrb. Mineral. Geol. Beil.-Bd.* 52A, 61-112(1925).—The methods of detg. mineralogical compn. from chem. analyses are reviewed. Numerous analyses are plotted on triangular diagrams to show mineralogical compn. and variations in compn. of different eruptive rocks.

J. F. SCHAIRER

A new deposit of intrusive sodium rocks in Portugal. PEREIRA DE SOUSA. *Compt. rend.* 185, 467-9(1927).—The syenites of the region of Vila Boim are in general more quartziferous than those of Alter Pedroso (cf. Lacroix, *C. A.* 11, 22). Five analyses by Raoult are quoted showing a series with decreasing SiO₂ and an av. of 7% of Na₂O.

L. W. RIGGS

Experimental studies on chemical processes in the formation of glacial clay. O. TAMM. *Sveriges geol. Undersökning* 18, No. 5(1924); *Intern. Rev. Sci. Practice Agr.* 4, 347-8.—Clay was artificially prepd. by rotating quartz flasks contg. small pieces of granite and H₂O, either free from or contg. CO₂, in a thermostat for 12 hrs. The rate of decompn. of the granite was nearly independent of the temp. but was largely dependent on the intensity of grinding and on the amt. of CO₂ present. The clays thus prepd. were similar to natural glacial clays even in chem. compn. The dissolved bases, MgO, CaO, K₂O and Na₂O, in water free from and contg. CO₂ amounted to 1.17 and 3.24%, resp., of the clay formed at the same time. The content of the 2 clays in chemically dissociated minerals was 15.6% in the presence of CO₂ and 6% without CO₂. The artificial clays appeared to have a higher content of biotite than natural glacial clays. Expts with K feldspar also indicated a high degree of decompn. and it is concluded that feldspar plays an important part in the change of granite into glacial clay. "These expts. throw light, in some respects, on the chem. processes concerned in the formation of glacial clay and furnish a method which may enable us to clear up the processes of hydrolysis and decompn. of the silicate minerals."

K. D. JACOB

Origin of the rock-marls in the French variegated red marls. GEORG FISCHER. *Neues Jahrb. Mineral. Geol. Beil.-Bd.* 51, 413-76(1925).—Geological. Many rock analyses are quoted and discussed. Several new analyses of rock-marls and concretions are given.

J. F. SCHAIRER

The Gleinalps locality as a metamorphic entity. F. ANGEL. *Neues Jahrb. Mineral. Geol. Beil.-Bd.* 51, 213-39(1924).—Petrographic. Equations showing chem. changes in mineral alteration are given.

J. F. SCHAIRER

Silicification of sedimentary rocks. C. W. CORRENS. *Neues Jahrb. Mineral. Geol. Beil.-Bd.* 52A, 170-81(1925).—Silicification of limestones occurs by means of acid or weakly alk. solns. while in clays silicification is caused by alk. solns.

J. F. S.

Occurrences of platinum metals. J. L. HOWE. *Science* 66, 220-1(1927).—It is probable that Pt and all of the Pt metals would be found in all meteorites if analyses were made with this end in view. An attempt is made to give a rough approximation of the relative amts. of the metals of the 8th group in the earth, assuming that the Fe of

the interior of the earth contains the same proportion of Pt metals as the Canyon Diablo meteorite. L. W. RIGGS

Geochemistry of the platinum-metals. ERICH HERLINGER. *Z. angew. Chem.* 40, 649-55(1927).—A review is given of the geochem. data on the occurrences and relations of the Pt metals to basic rocks. J. F. SCHAIRER

Precious stones. GEO. F. KUNZ. *Mineral Ind.* 35, 563-91(1926).—Discusses production of diamonds, rubies, sapphires, emeralds, pearls and other gems. A. B.

Studies on the distribution of iodine in nature. IX. The geochemistry of iodine. II. TH. VON FELLEBERG. *Biochem. Z.* 187, 1-6(1927).—See C. A. 21, 3034. S. MORGULIS

Biographical notices of mineralogists recently deceased. (Third series.) L. J. SPENCER. *Mineralog. Mag.* 21, 229-57(1927).—Brief biographies of 42 mineralogists. W. F. HUNT

MICHEL, HERMANN: **Die künstlichen Edelsteine.** 2nd ed., revised and enlarged. Leipzig: Wilhelm Döbner. 477 pp. M. 25. Reviewed in *Econ. Geol.* 22, 641-3 (1927).

9—METALLURGY AND METALLOGRAPHY

D. J. DEMORÉST, R. H. ABORN

Evolution of metallurgy in south-eastern France from its origin to the present time. PIERRE DEJEAN. *Technique moderne* 19, 523-44(1927). A. PAPINEAU-COUTURE

Aluminum from 1827 to 1927. AM. MATAGRIN. *Industrie chimique* 14, 152-3, 361-4, 344-5(1927).—Outline of the evolution of the Al industry during the last 100 yrs. A. PAPINEAU-COUTURE

The efficiency of metallurgical ovens. P. ROSIN. *Metall u. Erz* 24, 73 81(1927).—Graphical presentation of the heating efficiency of coal, oil and gas with preheating and with an excess of air. C. G. K.

Progress in ore dressing and coal washing in 1926. R. H. RICHARDS AND C. E. LOCKE. *Mineral Ind.* 35, 735 92(1926).—Recent tendencies are discussed, with examples of practice and an extensive bibliography. A. BUTTS

Systematic investigations in the field of theoretical metallurgy with reference to copper ores. W. GUERTLER. *Metall u. Erz* 24, 97-9(1927).—Discussion of previous work on the system Cu-Fe-S. C. G. K.

Mineral statistics. ANON. *Mineral Ind.* 35, 793-860(1926).—Tables of world production and trade in minerals and metallurgical products. A. BUTTS

Quicksilver. ANON. *Mineral Ind.* 35, 592-600(1926).—A review of the industry. A. BUTTS

Tin. F. BALIOL SCOTT. *Mineral Ind.* 35, 650-74(1926).—The world's tin industry is reviewed, with notes on metallurgy. A. BUTTS

Zinc. J. A. ZOOK. *Mineral Ind.* 35, 695-726(1926).—Production and trade in the U. S. and foreign countries are covered. A. BUTTS

Metallurgy of zinc. W. R. INGALLS. *Mineral Ind.* 35, 727-34(1926).—An outline of recent progress. A. BUTTS

Titanium and zirconium. J. W. MARDEN. *Mineral Ind.* 35, 675-83(1926).—New processes, use, and patents are discussed. A. BUTTS

Tungsten. C. G. FINK. *Mineral Ind.* 35, 684-94(1926).—An account of world production, with notes on metallurgy and a bibliography. A. BUTTS

Cadmium. C. P. LINVILLE. *Mineral Ind.* 35, 100-1(1926).—Discusses production and technology. A. BUTTS

Chromium. WM. D. JOHNSTON, JR. *Mineral Ind.* 35, 102-11(1926).—Includes Cr and compds., with statistics, technology, and bibliography. A. BUTTS

Copper. W. H. WEED. *Mineral Ind.* 35, 154-201(1926).—World production and trade are discussed, with statistics. A. BUTTS

The metallurgy of copper in 1926. L. S. AUSTIN. *Mineral Ind.* 35, 207-42(1926).—A review. A. BUTTS

Copper alloys and utilization of copper. WM. G. SCHNEIDER. *Mineral Ind.* 35, 201-7(1926).—Discusses world consumption. A. BUTTS

Cobalt. C. W. DRURY. *Mineral Ind.* 35, 150-3(1926).—Developments in production, metallurgy, and uses are treated, with bibliography. A. BUTTS

Nickel. THOS. W. GIBSON. *Mineral Ind.* 35, 474-81(1926).—World production and technology are discussed, with statistics. A. BUTTS

Platinum. GEO. F. KUNZ. *Mineral Ind.* 35, 530-49(1926).—World production and technology are covered, with tables of compn. of crude Pt and Pt ores. A. B.
Iron and steel. O. R. KUHN. *Mineral Ind.* 35, 341-94(1926).—The industry is reviewed as regards world production and trade and new metallurgical developments. A. BUTTS

Gold and silver. M. W. VON BERNEWITZ. *Mineral Ind.* 35, 254-322(1926).—World output and progress in metallurgy are reviewed. A. BUTTS

Lead. R. M. SANTMYERS. *Mineral Ind.* 35, 395-422(1926).—A review of production, consumption, and trade in the U. S. and foreign countries. A. BUTTS

Metallurgy of lead in 1926. O. C. RALSTON. *Mineral Ind.* 35, 423-33(1926).—A review. A. BUTTS

Molybdenum. ALAN KISSOCK. *Mineral Ind.* 35, 468-70(1926).—Technology and production are discussed. A. BUTTS

Superficial refining of metals by diffusion. GRUBE. *Z. ges. Giessereipr.* 47, 173-4(1926); *Chimie et industrie* 18, 68(1927); cf. *C. A.* 21, 2407.—Investigation of the diffusion of Cr, Al, W and Mo into Fe and of Cr into Ni showed penetration to a depth of 2.5-5 mm. Compn. of the different layers was detd. by removing successive thicknesses of 0.05 mm. by means of a lathe and analyzing the turnings. Fe and Cr can diffuse into each other in all proportions. Diffusion of Al into Fe proceeds at an appreciable rate at 900°, and after 40 hrs. (temp. not stated) the metal contains 27% Al. In spite of their high m. p. W and Mo diffuse very easily. The concn. of W in the superficial layer is not high; but the rate of diffusion is so rapid that it cannot be greatly increased. A. PAPINEAU-COUTURE

Reactions and equilibria in the system copper-iron-sulfur with reference to copper ores. O. REULFAUX. *Metall u. Erz* 24, 99-111(1927).—Phase diagrams and photomicrographs are given for the systems Cu-Fe, Cu-S, Fe-S, Cu₂S-FeS, Cu-Fe-FeS-Cu₂S. *Ibid* 129-34 (with W. GUERTLER).—Discussion of the above systems with bibliography. C. G. K.

Method of approximate analysis of an ore (copper) which can readily be pulverized into separate particles. K. WAGEMANN. *Metall u. Erz* 24, 52-5(1927).—The method is based upon microscopic appearance of different Cu minerals and gang in crushed ore. C. G. K.

Production of metallic cobalt from cobalt-bearing works-residues. A. BREMHORST. *Metall u. Erz* 24, 7 8(1927).—An exptl. procedure is described for treating residues low in Co and high in Fe, Mn and Zn. The residue is roasted 8 hrs. with C and Na₂SO₄ at 1000°, then at 1300° with a flux, giving a bottom layer contg. 80% of the original Co, and consisting of 66% Co and 29.5% S. Further roasting raised the Co content to 90-93%. C. G. K.

Ammonia leaching processes for zinc ores. H. M. LAWRENCE. *Bull. Am. Zinc Inst.* 10, No. 5-6, 107-18(1927).—With the aid of a flow sheet the author describes the NH₃-CO₂ leaching process as it is usually carried out. The Zn-bearing material, after grinding, is agitated with (NH₄)₂CO₃ soln. The Zn, Cu and Cd dissolve; the Pb becomes insol. basic carbonate. The Cu and Cd are removed from the Zn-bearing liquors by displacement with Zn. Steam distn. of the liquors yields basic Zn carbonate which is filtered and calcined to ZnO. NH₃ and CO₂ are recovered in the distillate as well as by liming the filtrate. The author discusses the following: (1) the difficulties involved in putting the process into commercial operation, (2) the patents involved, and (3) exptl. plants now operating. The results of a series of expts. on Zn ores and concentrates show that the percentage of Zn extd. by the NH₃ leaching process may be anywhere from 2 to 50% less than when the H₂SO₄ leach is applied to the same material. The yield of Zn in the NH₃ process is also more affected by the previous treatment and roasting of the ores. Expts. with Zn-Pb fume show that an almost complete extn. of the Zn can be accomplished with the NH₃ leach. A recently patented blast furnace process for smelting Zn ores is discussed. WILLIAM F. EHRET

The preparation of pure platinum from the ore. V. V. LEBEDINSKII and V. G. KHELOPIN. *Ann. inst. platine* No. 4, 317-23(1926).—To 100 g. Pt ore add at first at 70-80°, then at a boil 1-1.2 l. of a mixt. of 1 vol. HNO₃ (d. 1.4), 3 vol. HCl (d. 1.19) and 4 vol. of water, and allow to evap. under a pressure of 30 mm. Hg. The residue, including Os, Ir, etc., is mixed with 160-165 concd. H₂SO₄ and heated for 2-2.5 hrs. on a water bath and then on a sand bath at 140-142° till all HCl has disappeared. The diluted soln. gives (NH₄)₂PtCl₆ with NH₄Cl. The evapd. residue on cooling sets to a cryst. mass which is diluted with 500-600 cc. water and heated for 1/2 hr. on the water bath to drive off HNO₃. Filter and add 150 g. solid NH₄Cl. The pure (NH₄)₂PtCl₆

which is formed is washed with satd. NH_4Cl soln., ice water and alc. Its purity has been shown by cond. and thermal resistance measurements. WILLIAM M. MALISOFF

Methods of handling gold and platinum wastes. C. M. HOKR. *Metal Ind.* (N. Y.) 25, 371-2(1927); cf. C. A. 21, 2452. E. H.

The relation between the behavior on roasting and the mineralogical nature of Sieglund spathic iron ore. H. SCHNEIDERHÖHN. *Ber. Erzausschusses Ver. deut. Eisenhüttenleute* 1925, 1-4; *Chem. Zentr.* 1926, I, 1789.—A crude spar with fine quartz fragments and lamellar quartz requires the addn. of 3% of coke for roasting, while an almost pure ore requires 7-8% of coke. The former is fractured and broken up by the different coeffs. of expansion of the various minerals, so that oxidation and disson. can take place more readily and more rapidly. C. C. DAVIS

Coöperative research in ferrous metallurgy and the problem of inclusions in steel. A. C. FIELDNER. *Proc. Eng. Soc. West. Penn.* 43, 221-54(1927).—Coöperation among the U. S. Bureau of Mines, the Carnegie Institute of Technology and the iron and steel industry are discussed. E. H.

Some features of Australian blast-furnace construction and practice. DAVID BAKER, JR. *Proc. Eng. Soc. West. Penn.* 43, 255-66(1927). E. H.

The duplex process employed in India. I. B. YANESKE. *Blast Furnace Steel Plant* 15, 419-22(1927).—A combination of Bessemer and open-hearth processes consists of desilicizing and almost completely decarburizing molten pig iron in an acid-lined Bessemer converter and subsequently dephosphorizing the metal in the basic open-hearth. Description of the process as employed at Jamshedpur, India is given. A curve shows the av. rate of oxidation of C, Si, and Mn in the Bessemer converter during blowing, and tables show the compn. of Bessemer-blown metal required for various grades of basic open-hearth steel, the av. compn. of ladle samples of normal converter slags, the av. analyses of high-P Fe-Mn, and low-P Fe-Mn, and analyses of converter slag samples at different stages of the blow. W. H. BOYNTON

Effects of the average manganese content of the furnace charge and of the silicon content of the finished metal in the manufacture of steel tires. H. G. VOSGIENS. *Arts et métiers* No. 83, 289-94(Aug., 1927).—A sudden increase in rejected ingots and tires from 5-8% to 25-50% in a given plant was finally traced to variations in the Mn and Si contents. It was found that under the conditions of working at the particular plant the Mn content of the charge (exclusive of that added as Fe-Mn) should be maintained as high as possible and never be allowed to fall below 0.8%, and that the Si content should be such as just to give a still fusion (0.21% in the present instance). A. PAPINEAU-COUTURE

Chromium-nickel-electro-steel. KURT POPPE. *Zentr. Hüttenw.* 30, 91-4; *Chem. Zentr.* 1926, I, 2961.—With the aid of data obtained in practice with various melts and of chem. and heat balances, the attempt was made to develop a satisfactory process for the production of steel with high Cr and Ni contents for ingots weighing 4.5 tons. The results indicate that the length of the ingots should be 3-5 times the dimension of the greatest cross-section, and the thickness at the top 15-20% greater than that at the bottom. For cross-section a regular or an irregular polygon is recommended. The pouring temp. lies about 100° to 250° above the m. p. of the steel. Electro-Cr-Ni-steel is ordinarily cast in small ingots, so that the radial and axial sepn. of P, S and C can be disregarded in practice. C. C. DAVIS

Properties and economic importance of acid electric steel. L. GRINBERG. *Ousp. promychl. techn.* 1926, No. 4, 99-105; *Chimie et industrie* 18, 248-9(1927).—Outline of its manuf. and discussion of its merits. A. PAPINEAU-COUTURE

Hollow steel drilling rods. N. DANIELSEN. *Teknisk Tidsskrift, Uplaga C, (Bergsvetenskap)* 57, 25-7(1927).—A review considering the manuf. and properties of steel for hollow drilling rods and the manuf. of such rods. C. A. ROBAK

The iodine content of industrially prepared iron. TH. VON FELLEBERG AND GULBRAND LUNDE. *Biochem. Z.* 187, 7-14(1927).—See C. A. 21, 2864. S. M.

The occurrence of iodide in iron and iron slags. GULBRAND LUNDE and TH. V. FELLEBERG. *Z. anorg. allgem. Chem.* 165, 225-48(1927).—A method of extg. I from silicate slags with KOH and alc. is described in detail. If less than $2 \cdot 10^{-6}$ g. are present in the ext. obtained, then the I is detd. colorimetrically, but if more, the soln. is titrated with $\text{Na}_2\text{S}_2\text{O}_3$. I in Fe is detd. by dissolving Fe in hot H_2SO_4 or HCl and then using the methoxyl app. of Decker (*Ber.* 36, 2895(1903)). Various expts. are made to study the action and distribution of I in the course of the reaction, known quantities of KI and steel chips being used. These show that the H_2SO_4 soln. gives up but little of the I to alc.; that the alkali extn. is necessary, but not sufficient if all the crystals are not previously in soln.; and that a part of the I is retained by the C in Fe and cannot be

recovered by the method given. Other expts. show that I can be extd., from an acid soln. of pure FeSO_4 with alc., but not from the FeSO_4 obtained in dissolving steel chips; that the I remaining after acid treatment may be recovered by alkali extn.; that if Fe is dissolved rapidly, by heating strongly, then the HI present escapes before it becomes attached to the C formed, while slow heating gives it a chance to be absorbed by C before it is distilled; and the final expt. shows that besides C and Na_2SiO_3 , silicates, carbonates and sulfates, when used with FeSO_4 , have very little influence on the amt. of I retained in soln. The elements, found as impurities in various kinds of Fe and steel, are detd., the I content is obtained by a method similar to the one described, the methoxyl app. being substituted by a reflux condenser. All samples contain from 0.1 to 1.10 mg. of I per kg. of sample. The distribution of I between Fe and the silicate slags of the blast furnace is for 3 samples in the ratio of 100 : 40, 59, 72; and somewhat greater for the acid slags of the cupola furnace. The materials used and the products of the furnaces, ore, coke, limestone, castings and slags contain I. Various natural stones contain 0.2–0.3 mg. of I per kg. of stone.

J. BALOZIAN

A new pipe casting process in Choindez. M. VON ANACKER. *Bull. mensuel Schweiz Gas u. Wasserfack.* 7, 195–200(1927).—A description of a new centrifugal casting method for Fe pipe. Molten Fe is supplied to all parts of the mold at the same time before the centrifugal process is started. Tensile strength and other data are given for ordinary and centrifugally cast pipe.

R. W. RYAN

Spot welding of dissimilar metals. R. T. GILLETTE. *Gen. Elec. Rev.* 30, 443–5 (1927).—A few observations are made regarding the spot welding of certain ferrous and non-ferrous metals and alloys. Combinations of metals dissimilar in heat and elec. cond. are best welded by the use of 2 dissimilar electrodes such as Cu and Cu-W alloys of high W content. Where Cu-W or pure W is used, it is best to use inserts because of the cost and the introduction of too much high-resistance material into the welding circuit, if the whole electrode is made of either material. The machine used is illustrated and the heat distribution of 2 electrode combinations showing how and why electrode shape should be adjusted to metal thickness is shown. In line welding it is usually best to use an interrupter in the primary circuit of the welding machine, which gives, in effect, a series of overlapping spot welds and permits the employment of a higher welding current without danger of burning through the metal being welded.

W. H. BOYNTON

New method and instrument for the determination of Hertzian hardness. R. ESNAULT-PELTERIE. *Rev. métal.* 24, 396–400(1927); cf. *C. A.* 21, 551–2.—Further work with the previously described method and instrument brought out that the measurement of the radius of the contact circle was delicate and tedious, and that the machining and silvering of the test balls were extremely delicate. In order to overcome these drawbacks, E.-P. devised a method in which the total area of the contact circle is obtained by measuring the elec. resistance at the contact of the 2 balls. He gives a mathematical discussion of the theory of elec. resistance at the point of contact of 2 conducting bodies to prove the soundness of the principle of his method. It can only give a pressure-elec.-resistance curve (and even then only provided the secondary resistances are sufficiently const., or at least vary regularly), and the trend of the curve thus obtained is similar to that of the true theoretical curve, and particularly reproduces the angular points of the latter.

A. PAPINEAU-COUTURE

X-ray investigation of the internal stress in metals. SINKITI SEKITO. *Sci. Repts. Tôhoku Imp. Univ.* 16, 343–55(1927).—The x-ray spectra of a cold-worked Cu wire, annealed at different temps., were examd., to det. the magnitude of the internal stress. The app. and methods of calcn. are described. The internal stress in the crystals distorted the space lattice and decreased the breadth of the spectral line. Photograms of the wire are shown, and the breadths of 3 spectral lines are tabulated for different annealing temps. In wires reduced by cold drawing from 2.2 to 0.3 or 0.5 mm. diam., the lattice parameter was widened about 0.22%. The direction of greatest internal stress was perpendicular to the (111) plane, and that of the least, perpendicular to the (110) plane, the (100) plane being intermediate.

GEO. F. COMSTOCK

The surface tension of molten metals and alloys. YOSIHARU MATUYAMA. *Sci. Repts. Tôhoku Imp. Univ.* 16, 555–62(1927).—The surface tensions of 6 molten metals and 3 binary alloys are studied by the drop-weight method. A glass capillary 5 cm. long and 2 cm. inside diam. is fitted in a small elec. resistance furnace and molten metal allowed to drop into a weighing bottle under varying pressure in an atm. of CO_2 . The surface tension was detd. at temps. from 250° to 762° with Sb. The curves obtained for the pure metals were all linear and their slopes almost the same. Some surface tension results for Zn carried out in vacuum expressed in mg./mm. are 470°–78.8; 545°–

76.4; 635°-74.3. Other values obtained in vacuum are Sn 250°-58.7, 400°-55.6, 600°-51.6; Bi 350°-38.9, 600°-35.0; Cd 400°-65.3, 589°-60.2; Pb 370°-47.5, 657°-42.4; Sb 640°-37.5, 762°-37.2. The values for k as calcd. by the Eötvös formula differ from the usual 2.1 and approx. 1.1. A study of some binary systems shows that the intermetallic compds. do not decomp. during melting and exist in the liquid phase. A change of slope of the surface-tension curve is noted at the point of compd. formation. Some results obtained are: Sn-Pb alloy 20% Pb-38.0; 50% Pb-40.9; 80% Pb-43.6; 100% Pb-47.0; Sb-Cd alloy 0% Sb-65.0; 20% Sb-49.1; 40% Sb-42.8; 50% Sb-42.3; 60% Sb-40.6; 80% Sb-39.2; 100% Sb-37.4. So-Zn alloy 10% Sb-65.6; 45% Sb-41.8; 65% Sb-40.0; 85% Sb 38.6.

D. H. POWERS

Malleableizing kiln at Northwestern Malleable Iron Company. GEO. BEAKNEY. *Proc. Am. Gas. Assoc.* 1926, 794-805; see C. A. 21, 1245.

H. L. OLIN

The "hydrogen point" in iron. H. S. RAWDON AND PETER HIDNERT. *Phys. Rev.* 25, 898(1925).—Heated Fe absorbs a very appreciable quantity of H and the heating curves show that heat is evolved beginning at 325° to reach a max. at about 380°.

F. O. A.

The cause of variations in pig-iron qualities. R. S. McCaffery. *Am. Foundrymen's Assocn.* (preprint) No. 27-25, 7 pp.(1927).—Pig Fe is composed of 6 common elements, which form numerous binary or more complex compds. The temp. conditions in different blast furnaces or in different parts of the same furnace are not uniform, and the compds. formed in the furnace will vary as the time during which the Fe is held at certain temps. varies. The chem. analysis does not indicate how the elements are combined. The undetd. compds. formed at blast-furnace temp. may not be changed in remelting at lower temps., and must have considerable effect on the properties of the Fe.

GEO. F. COMSTOCK

Test bars to establish the fluidity qualities of cast iron. C. CURRY. *Am. Foundrymen's Assocn.* (preprint), No. 27-23, 17 pp.(1927).—Fluidity is defined as "the aptitude of a liquid in a given condition to fill a mold prepd. under detd. conditions." The fluidity of cast Fe is detd. by other factors beside temp. Previous methods of measuring fluidity are reviewed, with sketches of the test-bars used. An improved form of spiral bar for this purpose is described, and precautions necessary in its use are noted. The mold must be horizontal and accurate in dimensions, but venting and the moisture content of the sand were not important. Graphite mold-facing was found to assist the fluidity of Fe, and an oil spray had the same effect with brass. Instances are described of the value of definite fluidity tests on Fe, bronze and brass. Of various deoxidizers for Cu, Mn and P were most effective in increasing the fluidity and the malleability when cold.

GEO. F. COMSTOCK

Unusual microstructure of iron and tungsten. C. J. SMITHELLS AND H. P. ROOKSBY. *Nature* 120, 226-7(1927).—The peculiar microstructure found by Tritton (*Metallurgist* June, 1927) for iron and by the author previously for W was further investigated. By the x-ray reflection method it was found that the spots of the diffraction pattern of the subdivided large crystals are slightly spread out, indicating that the small grains formed by the subboundaries have nearly but not quite uniform orientation in each crystal. It is suggested that the subboundaries are formed under the influence of stresses set up during the rapid cooling of the metal.

B. J. C. VAN DER HOEVEN

Application of modern methods of testing iron castings. LE THOMAS. *Rev. métal.* 24 (Extraits), 339-42(1927).—Description of the system of tests adopted by the Etablissement d'Indret, near Nantes, France.

A. PAPINEAU-COUTURE

Cold-hardening and brittleness of steel: limit of brittleness. P. DEJEAN. *Rev. métal.* 24, 415-7(1927).—Resiliency tests carried out on a no. of test bars of the same steel (C 0.180, Si 0.265, Mn 0.54, S 0.016, P 0.016%) which had been subjected to different heat treatments (quenched and tempered, as forged, annealed) and then to increasing compressions showed that with low compressions the resiliency is practically unaffected, but above a certain crit. value of the compression (which varies according to the heat treatment, being greatest for the quenched and least for the annealed metal) the resiliency suddenly drops to a small fraction of its original value. The practical importance of this crit. value of compression in steel work (e. g., boiler heads) is pointed out.

A. PAPINEAU-COUTURE

An observation on the transformation in austenitic steel as induced by cooling in liquid air. H. S. RAWDON AND FREDERICK SILLERS, JR. *Phys. Rev.* 25, 898(1925).—When austenitic steel is cooled in liquid air it changes but little from the face-centered γ into the body-centered α , according to x-ray analysis.

F. O. A.

Carbon and manganese in tungsten magnetic steel. K. SCHÖNERT AND G. HANNACK. *Ber.* No. 73 Werkstoffausschusses des Vereins deutsche Eisenhüttenleute. *Sitz.*

Nov. 5, 1925; *Physik. Ber.* 7, 113.—The magnetic values were detd. with a Koespel app. at intervals of 0.01% C for steel of 0.50–0.75% C. The curves of residual magnetism and greatest inductivity show a pronounced break at 0.57% C. This is not evident in case of the coercivity force of the quality no. The increase in C is accompanied by an increase in Mn, but plotting the values against the Mn content did not serve to differentiate the influence of each element. E. R. SCHIERZ

The cause of temper-brittleness in steels. KOTARO HONDA AND RYONOSKE YAMADA. *Sci. Repts. Tôhoku Imp. Univ.* 16, 307–19(1927).—A review of recent literature on temper-brittleness is given, and the authors agree with Andrew and Dickie in associating the cause with carbide pptn. during slow cooling from 650°. Magnetic and elec. tests show temper brittleness as well as notched-bar tests. Brittleness depends on the amt. of carbide in soln. at the tempering temp., which is available for pptn. at the grain boundaries. The effects of Mo, N, P, etc. are explained by their effects on the carbide soly. below the A₁ point. A notched specimen is needed for showing the intergranular brittleness, but impact is not necessary. A Ni-Cr steel susceptible to temper-brittleness was tested by impact at various temps., and showed a marked increase in resistance at a lower temp. in the tough state than in the brittle state. GEO. F. COMSTOCK

Influence of the wall thickness of the ingot mold on the ingot. F. LEITNER. *Ber. No. 77 Werkstoffausschusses des Vereins deutsche Eisenhüttenleute. Sitz.* Nov. 5, (1925); *Physik. Ber.* 7, 106.—The influence of the thickness (between 75 and 25 mm.) of the mold wall on the primary crystn. and rate of solidification was detd. on blocks of soft Cr-Ni steels and steels rich in C and Mn. For blocks 140 mm. in diam., 250 mm. on edge, and 230–250 mm. diam. walls of 30–35 mm. and 35–40 mm. thick, resp., were found most favorable. Crystn. was better and the rate of solidification was about the same as with heavier walls. E. R. SCHIERZ

Stainless iron and its application to chemical-plant construction. W. M. MITCHELL. *Ind. Eng. Chem.* 19, 1171–5(1927).—Stainless alloys may be classified thus: 1. The original "stainless steel" of Brearley and Haynes, with a practical compn. range of 11 to 13% Cr and with sufficient C to confer hardening properties, usually 0.30 to 0.40%. 2. The "stainless irons," a modification of the above with similar Cr, but less C, usually under 0.12%. These are virtually mild stainless steels, and when first brought out were heralded as non-hardening. They do, however, possess distinct hardening properties, although not to the extent of type (1). 3. The alloys with over 16% Cr and low C (usually under 0.10%) with or without small addns. of other elements. These are more nearly true stainless irons as they have very little hardening capacity. 4. The Ni-Fe-Cr alloys, the compn. ranges of which may vary considerably. 5. High-Cr alloys contg. upward of 20% Cr and with medium or high C, and without the addn. of appreciable percentages of other elements. Properties of these alloys, their behavior upon heat treatment and when brought into contact with chemicals, their behavior upon fabrication, and suggestions as to the best ways of using them, are given in detail. W. C. EBAUGH

Rust-proof steel. B. STRAUSS. *Z. Elektrochem. angew. physik. Chem.* 33, 317–21 (1927); cf. C. A. 20, 3438.—A review of the development of Ni-Cr steel and its varied applications. The presence of free C in Cr-steel destroys the resistance of this alloy to corrosion, but if the carbide is in soln. this property is not destroyed. The addition of Ni facilitates the soln. The C content has an important influence upon the magnetic properties, an alloy with 0.16% C, 20.5% Cr and 6.8% Ni giving for magnetic satn. 845 lines when quenched at 1180° and 1845 lines heated at 800° for 8 hr., while an alloy contg. 0.23% C, 20.4% Cr and 6.8% Ni gave 17 and 990 lines under the above conditions. H. STOERTZ

Selection of corrosion-resistant alloys. W. M. MITCHELL. *Blast Furnace Steel Plant* 15, 427–34(1927).—A discussion of factors causing corrosion and of the characteristics of the different types of alloys best suited to combat it. Modern methods of combating are: methods based on the treatment or elimination of the corroding material or liquid; the use of a protective coating of another metal or by a substance in the form of a paint or enamel; electrochem. protection; replacement of the metal attacked by some other metal, inherently immune or whose resistance to attack is greater than that of the metal employed. The mechanism of corrosion, the effect of homogeneity of the metal, and of dissolved O on corrosion, surface films, the effect of electrolytes in soln. and the types of alloys, Fe-Si, Cr-Ni-Fe, Fe-Cr alloys and non-ferrous alloys are considered. External factors which affect corrosive attack are listed. W. H. B.

Miscibility gap in liquid iron-copper alloys. RUDOLPH RUER. *Z. anorg. allgem. Chem.* 164, 366–76(1927).—A reply to Müller's criticism of a previous article by Ruer

and Goerens (*C. A.* 12, 577). The soly. curve of liquid Fe-Cu alloys shows no critical point such as given by Müller at about 1500°, nor at any other temp. Even with slow cooling down to 1445° and vigorous stirring, there was no flowing together of the 2 layers which sepd. at higher temps. It was possible to produce the sepn. of 2 layers in some cases even as low as 1470°. Müller's failure to produce sepn. at temps. lower than 1500° is attributed to impurities or the absorption of traces of O. H. STÖERTZ

The constitution of iron-chromium alloys. EDMUND PEKULLA AND PAUL OBERHOFFER. *Ber. No. 68 Werkstoffausschusses des Vereins deutsche Eisenhüttenleute. Sitz. Nov. 5, 1925; Physik. Ber.* 7, 105.—The alloys were prepd. in a Mo vacuum oven using Al_2O_3 crucibles. Temps. were taken with an Ardrometer. A continuous series of mixed crystals was pptd.; no eutectic was observed. 10% HCl was used for etching specimens up to 20% Cr; above that 10% H_2SO_4 . The m. p. of pure Cr is higher than that usually accepted. Changes in the solid state were measured with a delicate dilatometer. Up to 10% Cr at 890° A_2 increases, then falls rapidly in intensity and is not detectable beyond 16%. A_2 decreases with increase in Cr content. Above 20% Cr the A_2 and A_3 curves coincide. Hardness increases with Cr content.

E. R. SCHERZ

Metallurgy and motors. J. A. MATHEWS. *Ind. Eng. Chem.* 19, 1089-91 (1927).—The metallurgist has contributed to automotive endeavor chiefly along 2 lines: (1) the production of new alloy steels; and (2) development of methods to improve the natural mech. properties of these by heat treatment. Some new alloy steels, the development of improved methods of manuf., and of non-corrosive steels are mentioned.

W. H. BOYNTON

The magnetic, electric and thermal properties of nickel-cobalt alloys. HAKAR MASUMOTO. *Sci. Repts. Tôhoku Imp. Univ.* 16, 321-32 (1927).—Pure Ni and Co were mixed in various proportions, fused, chillcast into rods, and annealed, and some properties of the alloys were detd. The results are tabulated and shown in the form of curves. The magnetization-concn. curve shows a min. at 6% Ni and a max. at 15%, for all fields. For weak fields, min. were also found at 30%, the lattice change-point, and at 70% Ni. Tests of magnetostriction showed a max. magnetic expansion at 30% Ni. The elec. and thermal cond. varied similarly, both showing max. at 25% Ni, and min. at 10 and at 70% Ni.

GEO. F. COMSTOCK

The coefficient of thermal expansion in nickel-cobalt and iron-cobalt alloys, and the magnetostriction of iron-nickel alloys. HAKAR MASUMOTO AND SITISABURO NAKA. *Sci. Repts. Tôhoku Imp. Univ.* 16, 333-41 (1927).—The thermal expansion of Ni-Co alloys was measured using a low rate of heating from 30° to 100°, and the expansion-coeff.-concn. curve showed a max. at 40% Ni, and min. at 30 and 65% Ni. A similar curve for Fe-Co alloys showed a max. at 65% Fe, and min. at 47 and 73% Fe. Alloys of high-purity Fe and Ni were chill-cast and annealed and their magnetic expansion was detd., the results being tabulated and shown as curves. Max. were found in all fields at 20 and 60% Ni, and a min. at 25%. In a weak field, another max. was found at 5% Ni and another min. at 15%. An alloy contg. 81% Ni showed no magnetic change of length.

GEO. F. COMSTOCK

Effect of work and annealing on the lead-tin eutectic. F. HARGREAVES. *J. Inst. Metals* (advance copy) No. 444, 12 pp. (1927); cf. *C. A.* 21, 1955.—Previous results are quoted to show that both Pb and Sn harden when cold-worked and that the presence of a 2nd constituent in a metal usually increases the time or temp. required for recovery from strain effects. Samples of the Pb-Sn eutectic were chill-cast, and cold-worked by hammering, the hardness being detd. by the Brinell method at different stages of working and aging. The procedure is described in detail. All the samples showed a reduction in hardness after working, especially after 30% reduction in thickness, and the severely hammered eutectic was softer than pure Pb or Sn. After heating or aging the hardness generally increased. The effect of cold-work on the microstructure was to destroy the contrast after $FeCl_3$ etching. After reheating, the contrast returned, slip zones appeared, and recrystn. occurred. The changes were probably similar to those occurring in the pure metals, but, because of complexity of structure, there was a large lag in the time factor. Also in *Engineering* 124, 375-6 (1927).

GEO. F. COMSTOCK

Heat treatment and grain growth in ($\alpha + \beta$) brass. R. HINZMANN. *Z. Metallkunde* 19, 297-303 (1927).—Results are given of expts. and tests carried out in the lab. and in the works on brass contg. Cu 50%, Pb 2%, and the rest Zn. This alloy is much used in forming pressed brass articles by forcing the heated metal into steel dies by means of hydraulic pressure. The alloy, upon solidification, yields only β -mixed crystals. Upon cooling below 700°, needle-like mixed crystals of α -brass begin to sep.,

thereby lending toughness to the otherwise brittle β -crystals. The best temp. for pressing the alloy is just above that at which α -brass begins to sep. At this temp. the β -crystals possess sufficiently good forming properties and the temp. is not so high as to induce grain coarsening. Heat treatment must also be carried on above the temp. at which the α -component seps. Slow cooling then yields needle-like α -crystals. Pressed articles often show very uneven surfaces and side cracks. The microstructure shows this to be due to the presence of α in the β -brass before pressing. The great pressure causes the needle-like crystals of α to ball together into chunky grains, thereby making the alloy brittle and subject to cracking. Further cause for the formation of side-cracks is found in the fact that before pressing, the rods are often very coarsely cryst. near the outside. This comes about as the rods are being pressed through the matrix. The temp. at the surface is lower than in the interior, thus giving rise to different degrees of deformation. This also accounts for the presence of granular α in β in the rods. The ability to change from the granular ($\alpha + \beta$) structure to the tougher needle like structure depends upon the aforementioned degree of deformation. Slight deformation requires a high recrystn. temp. and large crystals are formed. Marked deformation requires lower recrystn. temp. and finer crystals are formed. A study of the phys. properties shows that needle-like ($\alpha + \beta$) brass, obtained from the granular mixture by reheating, is somewhat more brittle than if the structure had resulted from slow cooling of the original melt.

WILLIAM F. EHRET

Properties of brass at the elastic limit. W. KÖSTER. *Z. Metallkunde* 19, 304-10 (1927); cf. *C. A.* 20, 3421.—In the tension-elongation diagram of brass a break is sometimes found in the curve of the elastic limit. This is analogous to the breaks found in the similar curves for ingot Fe. The break is confined to the Cu-Zn alloys sepg. in the heterogeneous condition and is coupled with the mech. arrangement of the components of the structure. There is a decrease in the tension at the elastic limit on the elongation curve of previously stretched brass. This decrease disappears when the samples are heated to 200°. The reason given for the observed decrease is that a metastable condition has been set up. The condition of stress which raises the elastic limit is brought on, on the one hand, by a certain grain structure of the heterogeneous alloy and on the other, by the distribution of stresses due to previous stretching of the samples.

WILLIAM F. EHRET

Constitution and physical properties of some of the alloys of copper, zinc and cadmium. C. H. M. JENKINS. *J. Inst. Metals* (advance copy) 446, 39 pp. (1927); cf. *C. A.* 20, 3420.—A very detailed study of the Cu-Zn-Cd alloys and 2 commonly used brasses contg. Cd is given including thermal and phys. data, equil. diagrams and photomicrographs. Cd is not completely volatilized from brass unless the metal is melted at high temp. Cd in brass causes little alteration in the properties of cold-rolled metal, but reduces the workability of 70-30 alloy when hot. The solid soly. of Cd in α brass diminishes with increasing proportions of Zn from a max. of 2.7%. Cd, beyond what is held in solid soln., occurs as Cu_2Cd . Alloys contg. α brass and more than a trace of Cu_2Cd melt between 549 and 614°. At 614° the β brass reacts with liquid to form α brass and Cu_2Cd changing the properties of the alloy. Increase in temp. increases the solid soly. of Cd in β brass, up to 8% Cd content. At low temp. the γ constituent has a greater power of retaining Cd in solid soln. than the β . Addns. of Cd up to 1% improve the tensile strength and reduce the elongation of brass.

J. W. SHIPLEY

Miscellaneous non-ferrous metals and alloys. H. W. GILBERT. *Ind. Eng. Chem.* 19, 1091-4 (1927).—G. deals with the odds and ends of the non-ferrous alloys employed in automotive transportation. The employment of anti-rust materials, the success of chem. and metallurgical control, an outline of unsolved problems, and of the application of other sciences by the metallurgical chemist are indicated. W. H. B.

Magnesium and its alloys. JOHN A. GANN AND ARTHUR W. WINSTON. *Ind. Eng. Chem.* 19, 1193-1201 (1927).—Results are given of phys. tests of the mech. properties of high-Mg alloys with the following metals: Al, Cu, Ni, Zn, Cd, Sn. New information on the compn. and m. ps. of the various eutectics and compds. formed in the above binary systems is given. Mn is often introduced into the alloys to reduce corrosion and to improve the mech. properties. The properties, compn. and uses of the several Mg alloys called "Downmetal" are discussed. A technic is suggested for the etching and polishing of the alloys. The microstructures of 25 diff. alloys are shown. Complete directions are included for the foundry practice, heat treatment, fabrication and surface finishing of Mg alloys. A list of the many present and possible uses of the alloys is appended.

WILLIAM F. EHRET

Bearing metal bronzes. H. J. ROAST AND FRED NEWELL. *Iron and Steel Can.* 10, 236-44 (1927).—Alloys made from Sn, Pb, Zn, Cu, Mn, P and Al were tested and

compared as to cost. Expts. indicated that re-melting for casting was unnecessary, providing the original melting and mixing were properly carried out. Increasing the Pb, and decreasing the Sn in a bronze does not necessarily soften it. A bronze made from good used metal is just as satisfactory as one made from virgin metal. A Zn-Cu-Al white metal alloy may be substituted for the more costly high Sn bronze for heavy pressure duty. Mn bronzes properly made combine in themselves greater strength, ductility and hardness than ordinary bronzes. A data chart and 35 photomicrographs showing the structure of the alloys discussed are given. Also in *Can. Mining J.* **48**, 651-9(1927).

The aluminum-silicon alloy "alpac" and its applications. LEON GUILLET AND G. SENSAUD. *J. four élec.* **36**, 196(1927).—Cf. *C. A.* **21**, 3337. C./G. F. J. W. SHIPLEY

Aluminum and its alloys. F. C. FRARY. *Ind. Eng. Chem.* **19**, 1094-5(1927).—An outline of the chem. problems, of recent developments, and of future problems in the manuf. of Al and its alloys. W. H. BOYNTON

Note on aluminum bronzes. J. MOREAU. *Arts et métiers* **80**, 218-21(1927); cf. *C. A.* **21**, 3036.—Photomicrographs of a no. of bronze test bars (Al 9-10%, Mn 1-3%) of different sizes and subjected to various mech. and thermal treatments are given and discussed, particularly from the standpoint of trying to translate the results of the micrographic examn in terms of tensile strength and reduction in cross sectional area.

Study of aluminum bronzes. JEAN BOULDOIRES. *Rev. métal.* **24**, 357-76, 463-73 (1927); cf. *C. A.* **21**, 560, 2245-6. A much more detailed account of the work with bibliography of 19 references. A. PAPINEAU-COUTURE

Corrosion-resistant aluminum alloys. E. H. DIX, JR. *Mining Met.* **8**, 395-6 (1927).—Strong Al alloys are best protected from intergranular corrosion by a thin coating of Al of high purity. A photomicrograph of an Al alloy sheet so protected is shown and discussed. The pure coating is electronegative to the strong alloy, so that slight exposure of the latter is not harmful. GEO. F. COMSTOCK

Knowledge of the corrosion of aluminum and its alloys in various electrolytes. N. IZGARUISHEV AND V. JORDANSKII. *Korrosion u. Metallschutz* **3**, 54-8(1927).—The corrosion of Al and its alloys with small quantities of Cu, Ni or Mg in various acid, base and salt solns. has been studied. The corrosion increases with the copper content of alloys, local cells explaining this effect. For pure Al, corrosion is greater in HCl (1*N*) than H₂SO₄ (2*N*); chloride and fluoride ions accelerate corrosion in H₂SO₄ (2*N*) while bromide and iodides are not so noticeable. The effects of solns. of other salts are also reported. J. K. ROBERTS

Orientation of aluminum crystals. KENZO TANAKA. *Japn. J. Phys.* **4**, 137-40 (1927).—Preliminary cold working, such as twisting, elongation and drawing before annealing, has no remarkable effect upon the orientation of the large single crystals in thin Al wires. The majority of the large single crystals are situated in such an orientation that their (210) axes are nearly parallel to the axis of the wire. With the Al plate the crystals are orientated rather at random. C. J. WEST

The lattice constant of metallic cobalt. SINKITI SEKITO. *Sci. Repts. Tohoku Imp. Univ.* **16**, 545-53(1927).—S. makes an x-ray investigation of metallic Co at room temp. and at 700° using an x-ray app. of the Siegbahn type with an iron anti-cathode. The exposures were carried out for 4 hrs. in an atm. of H₂. A sample of granular Co purified by electrolysis and then melted, forged and annealed gave an axial ratio of 1.622 and a lattice const. of 2.498 Å. U. These const. give a d. of Co of 8.89 and S. concludes that the α-cobalt lattice which is stable at ordinary temp. is a hexagonal close-packed type. The lattice const. as detd. at 700° is 3.558 Å. U. and gives a d. of 8.64. The observed and calcd. intensities show satisfactory agreement and S. concludes that the β-cobalt has a face-centered cubic lattice. A sample of electrolytic Co showed the presence only of the α-form. These results confirm the view of Masumoto (*C. A.* **21**, 559) that an allotropic transformation occurs in Co at 477° during heating and at 403° on cooling. The amt. of the discontinuous elongation calcd. from the lattice const. was 0.007 and is in satisfactory agreement with the dilatometric results obtained by M. D. H. POWERS

Some of the effects of sulfur on copper. P. SIEBE. *Z. Metallkunde* **19**, 311-15 (1927).—The presence of S in Cu has been variously considered as (1) beneficial, (2) detrimental, and (3) as without any effect. S usually occurs in Cu as SO₂ or Cu₂S. The effects of both of these on the phys. properties of Cu have been studied by S. Graphs of the phys. properties plotted against % impurity show that S in the form of Cu₂S, even when present up to 0.8%, has little influence upon the tensile strength of electrolytic Cu. The presence of 0.1% S, as Cu₂S, reduces the ductility about 10% and 0.8%

S reduces it about 14%. The Brinell hardness of samples contg. up to 0.8% S fluctuated irregularly between 45 and 59 Brinell units. Test specimens drawn into wires 2 mm. in diam. showed a gradual increase in tensile strength, reaching 10% when the S content was 5%. With increasing Cu_2S content the elec. cond. is gradually decreased. When % S = 0.45 to 0.7 the cond. of the Cu has fallen to 75% of its original value. The presence of Cu_2S greatly reduces the resistance to breaking under the bend test. S. concludes that the greater the amount of S (as Cu_2S) in excess of 0.12%, the poorer will be the quality of the sample as compared to pure Cu. The effect of the presence of S as SO_2 in Cu was studied by heating Cu with CuSO_4 . By decompn of the latter both SO_2 and Cu_2O are formed. The elec. cond. is reduced in a like manner whether the S is present as SO_2 or Cu_2S . However, all other phys. properties are very much poorer, at corresponding S percentages, when S is present as SO_2 . A graphical comparison of the effect of similar amts. of Cu_2S and Cu_2O on the phys. properties of Cu shows that the two act very much alike, the effect of the Cu_2O being slightly more pronounced in all cases. Photomicrographs are presented to show that Cu_2S particles in Cu are flattened out by rolling and are, therefore, rather soft. Cu_2O particles seem to be little affected by rolling. This is held to account for the increased softness and flexibility of Cu sheet contg. as much as 0.45% S as Cu_2S . The presence of a similar amt. of O_2 would render the metal more brittle. The presence of S has a further softening influence upon Cu in that it has a strong affinity for such metals as Ni and As which tend to form mixed crystals with Cu. By combining with the Ni and As the S diminishes their hardening influence.

WILLIAM F. EHRET

Galvanization and tinning of iron and steel wire. M. P. KRUMME. *Centr. Hütten Walzwerke* (March 16, 1927); *Technique moderne* 19, 474-5(1927).—A review of the chief processes of protection of iron and steel wire against oxidation. A. P.-C.

Rolled zinc and zinc-coated products for industrial structures. J. P. HUBBELL AND WM. H. FINKELDEY. *Trans. Am. Inst. Chem. Eng.* 18, 51-67(1926).—Precautions necessary in the use of rolled Zn and Zn-coated steel, and their marked resistance to atm. corrosion are pointed out. Resistance is less in atms. high in SO_2 and CO_2 . Zn-coated products discussed are galvanized sheets, wires, and structural steel, pipe and fittings, and hardware. A brief discussion is included. W. H. BOYNTON

Banded structure in Al and Cu (Flam) 2. Spectrographic detection and determination of impurities in Al and its alloys (ADAN) 7. Ra, U and V (HESS) 3. Machine for testing bronzes and anti-friction alloys (ANON) 1. Coal and ore washing process (RANWEZ) 21. The importance of various materials in the gas industry (DÜCKEL, PRAETORIUS) 21. Tunnel kiln for annealing metals (Brit. pat. 261,866) 19. Device for supplying O, oil, coal, ore or other substances to blast furnaces (Brit. pat. 261,776) 1. Water-jacketed gas producer or shaft furnace (Brit. pat. 262,668) 21.

AREND, J. P. *et al.*: **Manuel des laboratoires sidérurgiques.** Paris: Dunod. 312 pp.; 30.80 francs. Reviewed in *Bull. soc. ind. Mulhouse* 93, 306 7(1927).

FRANCHE, G.: **Traitement thermique de l'acier et ses essais.** Paris: Desforges Girardot & Cie. 239 pp.; 18 francs; 22 francs (postpaid). Reviewed in *Recherches et inventions* 8, 323(1927).

Ore-flotation apparatus. H. WALL. U. S. 1,642,051, Sept. 13.

Ore-sampling apparatus. O. H. GRAY and C. E. MURDOCK. U. S. 1,642,337, Sept. 13.

Apparatus for charging cupolas, etc. W. A. GRIFFIN. U. S. 1,643,208, Sept. 20.

Metal recovery. H. V. WELCH. Can. 271,592, June 14, 1927. Ores contg. Cu and Ag or Au are leached with a soln. contg. a sol. cyanide to dissolve the Cu and Ag or Au; these are pptd. from the soln. by the action of a pptg. agent. At least 4 mols. of cyanide to 1 mol. of Cu present are maintained in the soln. throughout to prevent the formation of insol. $\text{Cu}(\text{CN})_2$ compds.

Removal of oxide from ferrous metal. R. PORTER and J. C. WHETZEL. Can. 271,552. June 14, 1927. Oxide is removed from ferrous-metal articles by first immersing in a caustic alk. soln. to break down the resistance of the oxide to acid, and then immersing the articles in a hot acid soln. of 5-15% HCl or HNO_3 . Cf. C. A. 20, 1215.

Metallurgy of tin. E. A. C. SMITH. Can. 272,867, Aug. 2, 1927. Sn is recovered from materials contg. it by reducing the Sn in the material to the metallic state, leaching

the reduced Sn with a mixed solvent contg. a stannic salt, a ferrous salt and an acid, and electrolyzing the soln. to deposit a portion of the Sn and to regenerate the solvent.

Chloridizing roasting of ores. H. STEPHAN. Brit. 262,392, Dec. 4, 1925. In the chloridizing roasting of burnt ore such as Fe_2O_3 or the like for obtaining the valuable secondary metals such as Cu, Zn and Ag, the process is carried out in the presence of H_2O in the nascent state, *e. g.*, by the use of hydroxides such as $\text{Fe}(\text{OH})_3$ from which H_2O is split off at high temp. or by the use of cryst. salts contg. H_2O such as Na_2SO_4 , MgSO_4 , or NaHSO_4 , or by the use of acids which react with the chloride with production of H_2O .

Treating copper ores. W. DEWAR. Brit. 262,552, Oct. 6, 1925. Cu silicate in ore or other material is converted into oxide (so that it is sol. in an ammoniacal soln. or solvent in the absence of an oxidizing atm.) by subjecting the ore or other material contg. the silicate to a preliminary heating, which may be at $190\text{--}230^\circ$ in the presence of producer gas for $\frac{1}{2}\text{--}1$ hr. or the material may be heated in air at $500\text{--}550^\circ$. After heating, the Cu may be recovered by leaching without employing a current of air or O.

Apparatus for reduction of iron ore or other ores by hydrogen. S. L. MADORSKY. U. S. 1,642,683, Sept. 20.

Separating zinc blende from associated minerals by froth flotation. C. P. LEWIS. Brit. 262,492, Aug. 12, 1925. With a mixt. contg. a mineral such as PbS , sepn. is effected by use, together with a frothing agent, in such quantity as to be wholly in soln., of a small quantity of a metallic salt of an alkyl deriv. of sulfothiocarbonic acid such as an alkali xanthate, which prevents the ZnS from floating while the PbS is enabled to float. Several modifications of the process to different ores are described.

Treating lead dross. O. P. CHISHOLM. U. S. 1,642,358, Sept. 13. In treating impure Pb dross to remove Cu as a speiss, the dross is mixed with fluxes such as SiO_2 and lime rock and subjected to a smelting temp. to promote formation of a speiss contg. Cu and Pb, and the Pb in the speiss is then replaced by Fe without replacing the Cu.

Treating slag. A. CRAWFORD and J. CRAWFORD. Brit. 261,976, March 26, 1926. A small proportion of acid steel slag is added to blast-furnace slag, preferably while molten, to lessen the tendency of the blast-furnace slag to disintegrate.

Rotary puddling furnace. E. F. BLESSING. Brit. 261,812, July 17, 1925.

Furnace for melting type metal, etc. W. ALDERDICE. U. S. 1,642,351, Sept. 13.

Cast iron. H. HANEMANN. Brit. 262,043, Nov. 25, 1925. The proportion of fine flaky graphite in gray cast Fe is increased by heating to a high temp., *e. g.* $1400\text{--}1500^\circ$ for 15 min. or $1250\text{--}1300^\circ$ for 2 hrs. Test castings in the form of small rods may be made from time to time and the fracture or polished face of these observed to det. the progress of the transformation.

Alloyed steel and iron. G. and E. STIG. Can. 272,224, July 12, 1927. Alloyed steel and Fe with Cr is produced by bessemerizing an alloy until the C content is decreased to the desired degree but not lower than that required to retain a sufficient amt. of Si to avoid the formation of nitrides. The product is pulverized and mixed with a suitable quantity of pulverized metal oxides to oxidize the remaining Si. The mixt. is briquetted, and the briquets are introduced into melted Fe or steel to form an alloy.

Centrifugal refining of molten iron and steel. J. MAXIMOFF, M. S. DE COSTA and R. P. D. KREBS. Brit. 262,136, Nov. 28, 1925. An app. is described.

Alloy. S. E. WINSLOW. Can. 271,976, June 28, 1927. A metallic compn. comprises Ni and Cu in approx. the atomic proportions of 10 to 4, and Sn in an atomic proportion of not greater than 1.

Magnetic alloy. I. F. KINNARD. Can. 273,189, Aug. 16, 1927. A magnetic alloy contains Ni 60–80, Cu 40–20, and Fe approx. 2%. The alloy has a substantial and approx. a linear negative temp. coeff. of permeability between 0 and 100° , which gradually reduces to unity in the neighborhood of 100° .

Magnetic alloy of high permeability. E. GUMLICH. Brit. 262,153, Nov. 30, 1925. Fe 20–46, Ni 50–75 and Mn 4–14% form alloys having high permeability at low magnetizing forces, low coercive force and high elec. resistance.

Separating constituents of alloys. C.-G. BOSSIERE and H. ZANICOLI. U. S. 1,642,574, Sept. 13. See Brit. 241,880 (C. A. 20, 3442).

Steel alloy. L. M. BROWN. U. S. 1,643,054, Sept. 20. An alloy steel which is suitable for making cutting tools comprises C 0.40–1.00, Mn 0.50–1.50, Si 1.50–2.50 and Mo and V at least 0.15% of each and 0.50–1.00% of both together.

Alloy irons and steels. W. B. HAMILTON and T. A. EVANS. Brit. 262,206, Sept. 24, 1925. In making alloy irons and steels such as those contg. Cr, alloy Fe scrap such as rustless Fe scrap, with or without mild steel scrap, is melted with sufficient slag-

forming materials to form a slag of sufficient mass for starting and ore is then added with reducing material in such quantity as to reduce the added ore, the Fe oxide in the slag and the alloy metal compds. used. The C content of the metal may be reduced by addn. of oxide during melting.

Aluminum-base alloy. R. S. ARCHER. Can. 272,656, July 26, 1927. An Al-base alloy contains 3-15% Si, more than 0.8% Fe and 0.05-2.0% of a metal of the 6th group of the periodic system having an at. wt. less than 190.

Aluminum and lithium alloy. J. CZOCHRALESKI. Can. 272,309, July 12, 1927. Articles are made from an Al alloy contg. 1-42% Zn, up to $\frac{1}{2}$ of 1% Li, up to 4% Cu and the rest chiefly Al. The articles are heated to a temp. above 100°, and are then cooled. Cf. C. A. 21, 1247.

Aluminum alloy. W. A. MUDGE. Can. 271,780, June 21, 1927. In the manuf. of Al-Cu-Ni alloys, an alloy contg. not over 85% Al is added to a molten bath contg. Cu and Ni.

Alloy for electric conductors. W. S. SMITH and H. J. GARNETT. Can. 273,100, Aug. 16, 1927. An alloy suitable for loading telephone and telegraph conductors is composed of Ni 65, Fe 18, Cu 10, Cr 7, and Mn 0.5%.

Alloy for metal-cutting tool. W. A. WISSLER. Can. 273,209, Aug. 16, 1927. A cutting edge of a metal-cutting tool is composed of an alloy contg. Cr 15-40, W 15-35, B 0.5-2.5, C 0.75-2.5, Ni 15-50%, and a substantial quantity of Co. Cf. C. A. 21, 887.

Metal for bearings. H. M. WILLIAMS and A. L. BOEGEHOLD. U. S. 1,642,347, Sept. 13. A mixt. of finely divided Sn, Cu and salicylic acid, with or without graphite and Pb, is compressed into the desired form under a pressure of about 80,000 lbs. per sq. in. and heated to about 675° in a non-oxidizing atm. to form bearings or bushings. U. S. 1,642,348 specifies mixing finely divided alloyable metals such as Cu and Sn together with a finely divided material such as salicylic acid which volatilizes on heating, and heating the materials in the presence of a volatile flux such as NH_4Cl to effect alloying of the metals. U. S. 1,642,349 specifies mixing metals such as Cu and Sn with material such as salicylic acid and MgCO_3 which partially volatilizes when heated and leaves a residue serving as a supporting filler for the bearing material, compressing this mixt. and then heating it under non-oxidizing conditions to effect alloying of the metals and decompn. of the added auxiliary material.

Metal-treating composition. F. M. BECKETT. Can. 272,167, July 5, 1927. Molten metal is treated with a compn. composed of Zr, which is not combined with C, a percentage of Si in excess of half the Zr percentage, and an effective quantity of Mn capable of lowering the m. p. of zirconia-silica slags.

Surface treatment of aluminum. A. PACZ. Can. 273,443, Aug. 30, 1927. Al articles are provided with a hard, permanent surface by subjecting them to the simultaneous action of a sol. fluosilicate, a salt of a non-ferrous metal of the iron group and an alkali nitrate.

Annealing metal. A. S. MACDONALD. Can. 272,002, June 28, 1927. Non-ferrous metal is annealed without soaking by heating up to a proper annealing temp. by passage of current through it, and cutting off the current the moment such temp. is reached.

Tools of tungsten carbide, etc. F. KRUPP AKT.-GES. Brit. 262,723, Dec. 12, 1925. Solid bodies produced by pressing a mixt. of hard powder such as W carbide and softer powder such as Co, Ni or Fe are sintered at 700-1100°, shaped as far as possible, further sintered at a higher temp., and finished.

Apparatus for cooling and annealing metal bars. J. R. GEORGE. U. S. 1,642,437, Sept. 13.

Coating electron metal. W. PIEPER. U. S. 1,642,309, Sept. 13. In order to produce a weather-proof protecting coating on Mn base Zn-Al alloy or similar metals by oxidation, the metal is treated with a soln. of NaOH contg. KNO_3 , free from oily substances, and which also may contain other oxidizing agents such as Fe(OH)_3 .

Protection of metals from corrosion. S. D. and A. C. ZIMMERMAN. Can. 271,441, June 7, 1927. Metals are coated by immersion in a heated soln. of a sol. silicate held at a temp. below its b. p., and then heated.

Protecting ferrous metals from corrosion. T. E. MURRAY. Brit. 261,809, June 24, 1925. Fins of boiler tubes or other articles are coated with Cr and Ni, preferably electrolytically, and then heated in an oxidizing atm. to cause the Cr to alloy with the Fe and form an outer adherent oxide coating.

Prevention of rust on iron and steel. T. W. COSLETT. Can. 272,406, July 19,

1927. The oxidation or rusting of Fe and steel is prevented by treating with a soln. of H_3PO_4 contg. Zn and B. Cf. C. A. 21, 372.

Soldering flux. C. J. MEIER. U. S. 1,642,884, Sept. 20. A flux is formed from Zn 240, HCl (1.2 sp. gr.) 567, aq. NH_3 (0.9 sp. gr.) 142, NH_4Cl 15, Bi subnitrate 60, alc. 12 and spirits of turpentine, 2 parts.

Solder for aluminum. A. J. LINE. Brit. 262,192, Sept. 8, 1925. Ag 3 and Al 12 parts are melted together or mixed in the form of filings.

Weld rod for arc welding. C. B. LANGSTROTH and G. G. WUNDER. U. S. 1,643,274, Sept. 20. Metallic wire is coated with wood flour previously digested, e. g., with an alk. soln., to remove its gas-producing properties.

Apparatus for pickling coils of wire or rods. H. A. BEACH and H. K. BEACH. U. S. 1,643,186, Sept. 20.

Ingot mold. EMIL GATHMANN. U. S. 1,643,241, Sept. 20.

10 - ORGANIC CHEMISTRY

CHAS. A. ROULLER AND CLARENCE J. WEST

New methods of complex organic synthesis from elements. V. P. KRAVETZ. *J. Chem. Ind.* (Russia) 2, 335-7; *Chem. Zentr.* 1926, I, 3313.—A review. C. C. D.

Direction lines in organic chemical synthesis. J. P. WIBAUT. *Chem. Weekblad* 24, 370-5.—An address. The trend of org. synthesis with growth of this branch is discussed. The use of org. reactions in compd. prepn., studies on structure with proof of structure, catalytic reactions, hydrolytic splitting and enzyme reactions are presented.

M. ACHTERHOF

A new class of tautomeric compounds; ionic theory of tautomerization. CHARLES PREVOST. *Compt. rend.* 185, 132-4 (1927).—The word *synionie* is given to designate those properties exhibited where a mobile group is attached to an atom which in turn is connected by a double bond to another atom. For instance, there exists the possibility of the following forms: $\text{A} = \text{B} - \text{CX}$ (I) may ionize to $\text{A}^+ - \text{B}^- - \text{C}^+$, X^- which is also an active form of $\text{XA} - \text{B} = \text{C}$ (II) (cf. Lowry, C. A. 20, 3620). When X is only slightly mobile, I and II can exist separately. If X is very mobile there are two possibilities: either it occupies that position giving it greater mobility (pseudoisomerism), or, if the influence of A and C are similar, I and II exist together (desmotropism). Examples are given showing the effect of physical conditions and groups on the foregoing tautomerization. P. chooses the ionic theory because it is the only one providing an explanation for the influence of substituents and physical conditions on the nature of the tautomerization.

FREDERICK C. HAHN

Oxidation of wood charcoal with sulfuric acid. ERNST PHILIPPI AND REINHARD SEKA. *Monatsh.* 48, 375-89 (1927).—By using 100 g. charcoal and 1200 g. H_2SO_4 (d. 1.83), the following yields of pyromellitic acid are obtained from the following woods (g. pure acid): hazel, 1.5; beech, 1.13; willow, 0.75; cherry, 1.4; apple, 1.1; sycamore, 1; birch, 1; alder, 1; linden, 2. In studying the gases of the oxidation reaction it is found that the SO_2 curve sinks between 100° and 250° (15-75 min.) at first rapidly, then slowly and then remains nearly horizontal ($75-165$ min.); the CO_2 curve gradually increases between 225° and 300° (2nd hr.), then follows a noticeable min. with nearly const. temp. (3rd hr.) and finally an increase to about the previous height, and remains const. to the end of the reaction. The residual gas consists of CO and is 6-8% for 2-2.5 hrs. and then increases until it is 30% at the end of the reaction.

C. J. WEST

Oxidation of *n*-triacontane. FRANCIS FRANCIS AND N. E. WOOD. *J. Chem. Soc.* 1927, 1897-902.—The similarity is shown between the oxidation of synthetic $\text{C}_{30}\text{H}_{62}$, the mixt. of solid hydrocarbons termed paraffin wax and the pure constituents isolated from the latter; this extends not only to the velocity of oxidation but to the nature and amts. of the products formed. The highest acid present among the acidic products of the oxidation of $\text{C}_{30}\text{H}_{62}$ has 26 C atoms and appears to be identical with cerotic acid from beeswax. Other acid products were $(\text{CH}_2\text{CO}_2\text{H})_2$, $\text{C}_{24}\text{H}_{48}\text{O}_2$, $\text{C}_{26}\text{H}_{50}\text{O}_2$, $\text{C}_{16}\text{H}_{32}\text{O}_2$, $\text{C}_{22}\text{H}_{44}\text{O}_2$ and probably others. The inert products contain a compd., $\text{C}_{20}\text{H}_{40}\text{O}_2$, m. 69° , either a ketonic alc., or a di-HO deriv.; from the residue was isolated a ketone, $\text{C}_{40}\text{H}_{80}\text{O}$, m. 62.5° , purified through the oxime. The ketone is probably $\text{Me}(\text{CH}_2)_{18}\text{CH}_2\text{COPr}$.

C. J. WEST

Optically active borohydroxyisobutyric acid. J. BÖSEKEN, H. D. MÜLLER AND R. T. JAPHONGJOUW. *Rec. trav. chim.* 45, 919-22 (1926).—The resolution of asymmetric B compds. derived from α -hydroxyisobutyric acid and α -hydroxy- α -methylbutyric

acid has been effected by means of their brucine salts. A soln. of α -hydroxyisobutyric acid (2 mols.), boric acid (1 mol.), and brucine (1 mol.) in the minimal quantity of alc. was heated at 50° in a vacuum desiccator, the vitreous mass dissolved in ether, and the ether evapd., until the residue after drying over P_2O_5 was sol. in $CHCl_3$. Fractional extn. of this soln. with light petroleum yields the *l*-brucine *l*-di(α -hydroxyisobutyryl)-borate, $[\alpha]_D^{18} -55.8^\circ$, while the $CHCl_3$ residue contains the *ld*-salt, $[\alpha]_D^{18} -25.6^\circ$, both of which slowly change to the const. value, $[\alpha]_D^{18} -42^\circ$, of the racemate. By substitution of the appropriate base instead of brucine in the above prepn., the cryst. aniline, *o*-toluidine, and dimethylaniline salts are obtained. Similar resolution of brucine di-(α -hydroxy- α -methylbutyryl)borate yields the *ll*-isomeride, $[\alpha]^{18} -44.4^\circ$, and the *ld*-form, $[\alpha]_D^{18} -16.1^\circ$, both changing to the value of the racemate, $[\alpha]_D^{18} -28^\circ$. B. C. A.

Mutual transformations of alkyl phosphites. M. JANCZAK. *Rocz. Chem.* 6, 774-93(1926).—Na di-Et, di-Pr and di-*iso*-Bu phosphites are converted by the action of $AgNO_3$ into the corresponding Ag salts, which are also produced, although in smaller yield, from the corresponding acids. This supports the view that P is trivalent in the ester salts, but quinquivalent in the acid esters. $EtONa$ reacts with $(EtO)_2PH:O$ to yield $(EtO)_2POONa$, $EtO.PH(O)ONa$, Et_2O and $EtOH$. With $(EtO)_2PEt:O$ it reacts as follows: $(EtO)_2PEt:O + EtONa \rightarrow EtOPeEt(O)ONa + Et_2O$, while no reaction takes place with $P(OEt)_3$, $EtOPH(O)ONa$ or $EtO.PEt(O)ONa$. B. C. A.

Decomposition of some halogenated sulfides and the nature of the "polymeric" ethylene sulfides. E. V. BELL, G. MACD. BENNETT AND A. L. HOCK. *J. Chem. Soc.* 1927, 1803-9.—An indication of intermol. addn in a γ -halogenated sulfide was obtained by the conversion of γ,γ' (C_2H_5)₂S into the corresponding diiodide; on keeping the latter decompd., giving $1(CH_2)_3I$ and a dark viscous material contg. ionic I. Heating 2.5 g. $(ClCH_2CH_2)_2S$ in a sealed tube for 18 hrs. in boiling PhOH vapors gives 0.5 g., (50%) of dithian and $C_2H_4Cl_2$, the formation of dithian is due to a series of reactions involving both the intermol. and the intramol. types of addn. Similarly, dithian heated at 180° with excess of $C_2H_4Cl_2$ gives $(ClCH_2CH_2)_2S$, showing that the reactions are reversible at each stage. The "polymeric" ethylene sulfide of class I (cf. Meyer, *Ber.* 19, 3262(1886)) gives no dithian when dry-distd. or when heated in boiling PhOH for several hrs.; heated with $C_2H_4Br_2$ at 130° for 18 hrs. it gives dithian; dithian also results when PhOH satd. with HBr is used. $S(C_2H_4OH)_2$, $C_2H_4(SC_2H_4OH)_2$ and $S(C_2H_4S-C_2H_4OH)_2$ yield dithian readily when heated with a boiling soln. of HBr in PhOH. C. J. WEST

cis-trans-Isomerism of disulfoxides. E. V. BELL AND G. MACD. BENNETT. *J. Chem. Soc.* 1927, 1798-803.—Oxidation of 1,4-dithian by H_2O_2 in glacial AcOH at 0° for 24 hrs. gives the α -disulfoxide (Crafts, *Ann.* 124, 110(1862)), decomp. 263° , monoclinic, $a:b:c = 1.267:1:0.979$, $\beta 104^\circ 3'$; d_4^{20} (vac.) 1.570; 100 cc. EtOH dissolves less than 1 g. at the b. p. and approx. 0.1 g. at 20° ; 90.7% EtOH at 22° dissolves 0.38 g. From the mother liquor there is isolated the β -dithian dioxide, decomp. $235-50^\circ$, anorthic system, d_4^{20} (vac.) 1.554; crystallographic data are given; it is 3 times as sol. in cold EtOH as the α -isomer; in 100 cc. 90.7% EtOH, 2.26 g. dissolves at 22° . The oxidation product contains 11% of the β - and 89% of the α -isomer. Both isomers are reduced by Zn and HCl to 1,4-dithian. The two isomers could not be interconverted. α -Dimethylethylene disulfoxide, m. $163-4^\circ$; β -isomer, m. $128-30^\circ$; at room temp. 100 cc. soln. in AcOH contains 0.16 α - and 0.42 g. β -isomer. It is tentatively assumed that the α -isomer is the *trans* form. C. J. WEST

Methods for condensing aldehydes and ketones. VICTOR BOULEZ. *Rev. parf.* 7, 380(1927).—Condensation of citral and Me_2CO is obtained rapidly without need for agitation or other solvents and without resinification, in concd. aq. Na salicylate soln. to which has been added more or less free NaOH or KOH. The excess Me_2CO and the Na salicylate can readily be recovered. Citral and Me_2CO can also be condensed by diffusional in an alc. soln. of dry neutral K soap. A. P.-C.

Configurational relationships of 2-hydroxybutyric and lactic acids. P. A. LEVENE AND H. L. HALLER. *J. Biol. Chem.* 74, 343-50(1927); cf. *C. A.* 20, 579.—*d*-2-Hydroxybutyric acid was transformed into 1,2-dihydroxybutane. $ClCH_2CO_2Et$ was converted into $HOCH_2CO_2Et$. The latter was reduced by fermentation to *d*-1,2-dihydroxybutane. This glycol was converted into the *l*-chlorohydrin, which was reduced to *d*-EtMeCHOH. Hence, *l*-1,2-dihydroxybutane derived from *d*-2-hydroxybutyric acid yields *l*-EtMeCHOH and *d*-2-hydroxybutyric acid has the same configuration as *d*-lactic acid, *i. e.*, it belongs to the *l* series of hydroxy acids. ARTHUR GROLLMAN

Methylmercuric halides and hydroxide. L. B. HINKEL AND T. H. ANGEL. *J. Chem. Soc.* 1927, 1948-50; cf. Marvel and Gould, *C. A.* 16, 1561.—The conditions given for the prepn. of MeHgI by M. and G. resulted only in the production of the double compd., MeHgCl₂·2MeHgI (MeMgI + excess HgCl₂), m. 129°; this compd. has a more intense and unpleasant odor than MeHgI. MeHgI is obtained from MeMgI and HgI₂. The double compd. is converted by HgCl₂ into MeHgCl. MeHgOH is obtained by shaking 10 g. MeHgI in 50 cc. MeOH and 2 cc. H₂O with 7 g. Ag₂O contg. 34% H₂O; the filtered soln. is evapd. to dryness, warmed to 30° with 20 cc. PhCl and EtOH added until soln. results. On removing the EtOH *in vacuo* and repeating the purification several times, pure MeHgOH is obtained, m. 145°. C. J. WEST

Natural rotatory dispersion, in the ultra-violet, of aqueous solutions of neutral sodium, potassium and ammonium tartrates. R. DESCAMPS. *Compt. rend.* 185, 116 9 (1927); cf. *C. A.* 21, 3045.—Results obtained at λ 5780 to 2536 on solns. of neutral Na, K and NH₄ tartrates and tartaric acid partially neutralized with NaOH, by means of a special photographic spectropolarimeter (*Compt. rend.* 182, 22 (1926)) are tabulated and discussed. The dispersion curves ($[\alpha]$, λ^2) for the neutral tartrates rise regularly with decrease in wave length, reach a max. between λ 3022 and 2894, then fall off sharply and $[\alpha]$ changes sign. This confirms Lowry and Austin (*C. A.* 16, 3581) as to the complexity of the $[\alpha]$ of alkali tartrates in the visible spectrum, while the NH₄ tartrate curve does not agree with Nutting's (*Phys. Rev.* 17, 1(1903)). The Darmon lines of the neutral tartrates and the partially neutralized tartaric acid do not converge to the intersection point of the Darmon lines of tartaric acid solns., the difference being greater in the ultra-violet than in the visible spectrum. In passing from tartaric acid to tartrate soln. by progressive neutralization, the Darmon lines corresponding to successive stages of neutralization intersect along a given straight line. A. PAPINEAU-COUTURE

Separation of the optical antipodes of chlorobromopyruvic acid. MARIO GARINO AND GIORGINA BORNATE. *Gazz. chim. ital.* 57, 330-2(1927).—The method adopted for the sepn. was to prep. the salts with optically active alkaloids, for which purpose quinine, cinchonine, strychnine and brucine were chosen. The results were without success, as described in the following expts. ClBrCHCOCO₂H and quinine (equimol. parts) in EtOH evapd. at room temp. gave lustrous needles and a brown mother liquor. Attempts to recryst. the salt were unsuccessful, there being a marked tendency to form a brown resin. The unpurified quinine chlorobromopyruvate, which was very unstable, turned yellow at 135° and black through decompn. at 250°. A 1% EtOH soln. showed $[\alpha]_D^{15}$ —115°. Treated in a similar manner, cinchonine and ClBrCHCOCO₂H formed a non-crystallizable pitch. From hot alc. ClBrCHCOCO₂H and brucine (equimol. parts) there crystd. a salt, which, chiefly because of its practical insolv. in all solvents, could not be purified. The most favorable solvent was EtOH, in which 0.23% dissolved at 15°. The unpurified salt turned yellow at 108° and decompd. completely at 195°. Its 0.2% EtOH soln. showed $[\alpha]_D^{15}$ —37.5°. Alc. (ClBrC)CHOCO₂H and strychnine (equimol. parts) at room temp. gave a readily crystd. salt, which turned brown at 150° and decompd. completely at 185°. EtOH dissolved approx. 12% at 15°, CHCl₃ 20%, Et₂O 1% and water 1.75%, the soly. increasing with increase in temp. The value of $[\alpha]$ depended upon the solvent and the concn. For 1% solns. $[\alpha]_D^{15}$ was —31.5° in EtOH, —23.5° in CHCl₃ and —28.0° in water. Attempts to sep. by fractional crystn. the 2 optical antipodes from EtOH and CHCl₃ solns. did not give conclusive results, since the various fractions differed little or not at all in their $[\alpha]$ values. From 1.75% aq. solns. at 10° and then at 5° were obtained crystals which, tested immediately, showed in 1% aq. soln. a max. value of $[\alpha]_D^{15}$ viz., —64.3°. After 1 hr. this changed to —43.8° and after 3 hrs. to —30.2°. The salt, therefore, racemizes very rapidly and renders very difficult the sepn. of pure antipodes. Attempts at sepn. by means of microorganisms were also unsuccessful, racemization being more rapid than their destruction of one of the antipodes. C. C. DAVIS

α -Sulfo-*n*-valeric acid. H. J. BACKER AND M. TOXOPEUS. *Rec. trav. chim.* 45, 890-907(1926).—The prepn. and resolution of α -sulfo-*n*-valeric acid and its derivs. have been effected, and the dispersions of its salts detd. *dl*- α -Sulfo-*n*-valeric acid, + 1.5H₂O, m. 65.5° (Ba, Cu + 2H₂O, Ni + 2H₂O, Cu + 1H₂O, CuH + 5H₂O, Ag, AgII, aniline, m. 146°, strychnine + 4H₂O, strychnine II + 4H₂O, brucine + 6H₂O, brucine H + 2H₂O, salts described), may be obtained by the sulfonation of *n*-valeric acid; it is also obtained in 70% yield by the action of SO₃ on propylmalonic acid, and decompn. of the mixed malonic sulfuric anhydride, which is the initial product of the reaction. *d*- α -Sulfo-*n*-valeric acid, $[M]_{D^{25}} + 1.7^\circ$ (aniline, and aniline II salts), is obtained by repeated crystn. of the brucine H salt and is isolated as its Ba salt + 3H₂O,

[M] + 37°, while conversion of the mother liquors into the normal brucine salt and fractional crystn. yield *l*- α -sulfo-*n*-valeric acid, [M]₀₂₅ - 1.7° (BaH, Co + 2H₂O, Ni + 2H₂O, Cu + 1H₂O, CuH + 5H₂O salts), isolated as its Ba salt + 3H₂O, [M]₀₂₅ - 37°, which is also obtained by crystn. of the strychnine H salt of the *dl*-acid. The metal H salts of the active acids have approx. the same rotation as the parent acids, and show very little dispersion, but the normal salts show a much greater rotation and dispersion in aq. solns., but no dispersion in alc. soln. On heating aniline sulfovalerate with excess of aniline for 5 hrs., *aniline valeranilide- α -sulfonate*, m. 257° (decompn.) (Ba + 2H₂O, Co + 3H₂O, Ni + 3H₂O, and Cu salts), is obtained, which on resolution by means of its strychnine salt yields *d*-valeranilide- α -sulfonic acid, [M]₀₂₅ (in water) + 2.9°, isolated as its Ba salt, + 3H₂O (Co + 3H₂O, Ni + 3H₂O, and Cu salts). *d*-Sulfovaleric acid heated with excess of PhNH₂ yields aniline *l*-valeranilide- α -sulfonate. The metal salts of *d*-valeranilide- α -sulfonic acid in aq. soln. have practically the same rotation as the free acid, but in alc. soln. the value in each case is increased sixfold, and the Co and Ni salts show abnormal dispersion curves in this solvent, due, probably, to the coordination of the metal with the N. The action of *o*-C₆H₄(NH₂)₂ on α -sulfovaleric acid yields β -benzimidazolebutane- α -sulfonic acid (decompn. without fusion) in 70% yield (Ba + 4H₂O, Co + 5H₂O, Ni + 5H₂O salts), which is resolved by slow crystn. in the cold of a mixt. of the Ba salt and strychnine acetate, which yields the *d*-acid (Ba salt + 4H₂O, $\frac{1}{2}$ [M]₀₄₄ 14.8°, Co salt + 5H₂O). Treatment of *d*-sulfovaleric acid with *o*-phenylenediamine yields the *l*-benzimidazolebutanesulfonic acid, isolated as its Ba salt. B. C. A.

Synthesis of succinic dialdehyde. S. SUGAWA. *J. Pharm. Soc. Japan* No. 545, 551-7 (1927).—AcOEt, HCO₂Et and Na give Na formylacetic ester, which on treatment with EtOH-HCl gives β , β -diethoxypropionic ester (I) (yield 60%). Sapon. of I with EtOH-KOH gives the K salt of the propionate, which on electrolysis in aq. soln. gives succinaldehyde tetraethylacetal (yield 67%). The subsequent decompn. with mineral acid gives the dialdehyde. NAO UYHI

Action of the metallic derivatives of ethyl dehydroundecenoate upon alkyl halides. WM. W. MYDDLETON AND R. G. BERCHEM. *J. Chem. Soc.* 1927, 1928-30.—CH : C(CH₂)₈CO₂Et and AgNO₃ in EtOH give the Ag deriv., AgNO₃.CAG : C(CH₂)₈CO₂Et (I), sol. in hot EtOH and stable in bright sunlight. I and C₇H₁₅Br in EtOH give AgBr, EtO-C₇H₁₅ and the free ester; in the absence of EtOH C₇H₁₅ results. PrI, iso-BzI, EtBr and EtI also give quant. AgBr and the free ester. NaNH₂ and the ester give a Na deriv., which reacts like the Ag deriv. C. J. WEST

Configuration of oleic and elaidic acids. J. BÖESEKEN AND A. H. BELINFANTE. *Rec. trav. chim.* 45, 914-8 (1926).—A preliminary note outlining 2 methods by which it is hoped to det. the configurations of oleic and elaidic acids. In the first method, the Et esters are converted into the octadecenols and thence into octadecenes of similar configurations to the original acids. That obtained from elaidic acid m. +2°, and that from oleic acid m. about -15°. The second method is based on a comparison of the glycols obtained by oxidation with alk. permanganate or with peracids and subsequent hydrolysis of the oxido acid. B. C. A.

The saturation ability of rosin acids. III. B. M. MARGOSCHES, K. FUCHS AND W. RUZICZKA. *Chem. Umschau Fette, Oele, Wachse u. Harze* 34, 215-7 (1927).—A discussion of the "plus acid" in the I no. detn., and the analogy between abietic acid and pinene. The formation of HI when I is added to unsatd. fatty acids, is usually considered a secondary reaction, either by splitting off a neighboring H atom or by hydrolysis. M., F. and R. consider the HI formation a primary reaction, occurring as it does during the 5 min. required for the rapid method of I no. detn. developed by Margosches-Hinner-Friedmann the iodosous acid splitting off HI and forming an anhydride-like product, which later may also react with absorbed H₂O. The I no. of *d*-pinene ([α]_D = +34.65) by Hübl's method, with 70% excess of I, is 375, while *l*-pinene ([α]_D = -34.98) under the same conditions shows 251; by M.-H.-F.'s rapid method similar results were obtained. The free HI formed for *d*-pinene was 86% of the I used, equal to 83-50 = 36% "plus acid," and for *l*-pinene 68-50 = 18% "plus acid." It thus seems that the added I which det. the I no. also fixes the amt. of liberated HI. Since the unsatd. pinene is characterized by one double bond and one bridge-union, it is probably the latter which det. the amt. of HI. If it be assumed that the added iodosous acid splits off HI and forms in one case monoiodohydrin, C₁₀H₁₇O₂I, and in the other case the anhydride, C₁₀H₁₆O₂, then the monoiodohydrin would correspond to 75% acid (= 25% "plus acid") and the anhydride to 100% acid (= 50% "plus acid"). The free acid actually found for pinene and for abietic acid amts. to only 36%, lying between 25 and 50%, so that the 36% may represent a mixt. of these two compds. or of their isomers

and this would also confirm the abietic acid formula, which assigns to it one double bond and one bridge-union.

Anhydrides of aliphatic acids. D. HOLDR. *Chem.-Ztg.* **50**, 994-6(1926).—A review of the present knowledge of anhydrides and a discussion of their properties, methods of prepn., liability to decompn., and use for edible purposes. B. C. A.

Is melezitose a combination of sucrose with glucose? M. BRIDEL AND CH. AAGAARD. *Compt. rend.* **185**, 147-8(1927).—Of 3 prepn. made from cultures of *Aspergillus niger* by different methods, one hydrolyzes sucrose readily but has little action on melezitose; another hydrolyzes melezitose readily but has little action on sucrose. These facts do not support the hypothesis of Kuhn and von Grundherr (*C. A.* **21**, 64).

L. W. RIGGS

The presence of gentiobiose in the products obtained by the hydrolysis of maize. W. EKHARD. *Z. Spiritusind.* **50**, 145(1927).—A brief résumé of the work on isomaltose is given and the relation of the so-called isomaltose to gentiobiose is discussed. Gentiobiose is a component of the sirup known as isomaltose. The m. p. and the rotation of gentiobiose and its derivs. are given. Only 70% of the wt. of glucose produced by acid hydrolysis is fermentable.

C. N. FRIEY

Synthesis of lactose. AMÉ. PICTET AND H. VOGEL. *Compt. rend.* **185**, 332-4(1927).—Equal wts. of β -galactose and β -glucose were heated with a small amt. of ZnCl_2 (I) under 15 mm. pressure for 0.5 hr. at 175° , the product was dissolved in H_2O and I sepd. by the addn. of Ag_2CO_3 . The residue after evapn. of the filtrate was heated with Ac_2O and NaOAc and sapond. with NaOMe . The sugar thus obtained is believed to be lactose as checked by its rotation, osazone, acetate and nitrate. D. H. POWERS

Relation between rotatory power and structure in sugar group. I. C. S. HUDSON. *Bur. Standards, Bull.* **21**, 241-384(1926); cf. *C. A.* **20**, 2484.—A summary of the author's earlier work, and a collection of 10 papers published during 1924-25. A table of the rotatory powers of 104 pure substances examd. during the course of the work is given. B. C. A.

Synthesis of glucosides. I. Synthesis of indican. ALEXANDER ROBERTSON. *J. Chem. Soc.* **1927**, 1937-43.—*Me 3-hydroxyindole-2-carboxylate*, m. $157-8^\circ$ (I) (*Ac deriv.*, m. 145°) and tetraacetyl- α -glucosidyl bromide in $\text{KOH-Me}_2\text{CO}$ give *Me 3-tetraacetyl- β -glucosidoxyindole-2-carboxylate* (II), m. $229-30^\circ$; a suspension of 3 g. in dry MeOH , satd. at 0° with dry NH_3 gives 0.3 g. *3- β -glucosidoxyindole-2-carboxylamide*, darkens 245° , m. $254-6^\circ$ and a straw-colored liquid, probably impure *Me 3- β -glucosidoxyindole-2-carboxylate*, since with 6% HCl it gives I and with Ac_2O and AcONa it gives II. II and KOH in MeOH give the K salt (III) of *3- β -glucosidoxyindole-2-carboxylic acid*, m. $230-1^\circ$; dil. HCl contg. FeCl_3 gives indigotin. *1-Acetyl-3-tetraacetyl- β -glucosidoxyindole(pentaacetylindican)*, m. 148° , results from III, fused NaOAc and Ac_2O , from II and 5% Ba(OH)_2 at $40-5^\circ$ for 24 hrs., and from *1-acetyl-3-hydroxyindole* and tetraacetyl- α -glucosidyl bromide in $\text{KOH-Me}_2\text{CO}$. Dry NH_3 in MeOH converts this into *3- β -glucosidoxyindole(indican)*. C. J. WEST

Chemistry of starches. XX. Dispersion of polyamyloses. HANS PRINGSHEIM AND PAUL MEYERSOHN. *Ber.* **60B**, 1709-16(1927); cf. *C. A.* **20**, 1390.—The computed mol. optical rotation of diamylose (I) is 44,200, and of triamylose (II) is 72,200; the exptl. value for the mol. rotation of II is 73,400. Subtracting the mol. rotation of the γ -glucose residue (28,000) from the mol. rotation of I leaves 16,200 as the mol. optical rotation of the unknown constituent of I; subtracting $2 \times 28,000$ from the exptl. mol. rotation of II leaves 18,400 as the mol. optical rotation of the unknown constituent of II; similar computations with diamylose acetate gives a value of 19,100, and for triamylose acetate 104,300 and 101,500. Cryoscopic detns. give the mol. wts. of several acetate derivs. as follows: (the first no. gives the exptl. value, the second the calcd. value) in C_6H_6 diamylose acetate (III), 576; diamylose acetate (IV) from the decompn. by heat of tetraamylose acetate, 576; tetraamylose acetate (V) 1050, 1152; in glacial AcOH IV 577, 576; V 544, 1152; in PhOH V 618, 1152. The calcd. mol. wt. for hexaamylose acetate is 1728; the exptl. values are 1690 with glacial AcOH , 1705 and 1687 with C_{10}H_8 , 1587 with camphor, and 537 with PhOH . C. D. INGERSOLL

Saccharification of the dextrins. P. PETIT AND RICHARD. *Compt. rend.* **185**, 224-5(1927).—Dextrins were formed by the action of amylase and pptn. by concd. alc. at 50° and at 70° , different dextrins being produced at the different temps. These were purified by washing in boiling alc. and again were subjected to the action of amylase under temps. ranging from 20° to 70° , and the amt. of maltose formed was detd. For dextrins prepd. at 50° , the maltose formed may be represented by a linear equation, but for the dextrins prepd. at 70° , a logarithmic expression must be added to the linear equation in order to represent the maltose formed. L. W. RIGGS

d-Galacturonic acid from pectins. K. SMOLENSKI AND W. WLOSTOWSKA. *Rocz. Chem.* 6, 743-6 (1926).—A monohydrate of d-galacturonic acid, m. 116-20°, isolated from beet pulp, is described. B. C. A.

The so-called carbohydrate group in protein. (Preparation of glucosamine-mannose.) SIGMUND FRANKEL AND CURT JELLINEK. *Biochem. Z.* 185, 392-9 (1927).—An elaborate procedure was followed to sep. the carbohydrate group from egg albumin. This substance is found to be glucosamino mannose, which does not rotate polarized light, has no reducing power, and the amino group of which can only be freed by hydrolysis. S. MORGULIS

Azides. A. ANGELI. *Atti accad. Lincei* [6], 5, 732-6 (1927).—The unsettled problem whether HN_3 and its derivs. have open-chain formulas, $\text{HN}:\text{N}:\text{N}$, or ring formulas, $\text{HNN}:\text{N}$, is discussed. The various exptl. facts advanced in support of the chain

formula are in accord with the reactions: $\text{PhN}:\text{NNH}_2 + \text{O} \longrightarrow \text{PhN}:\text{N}:\text{N}$ and $\text{PhN}:\text{NCl} + \text{NH}_2\text{OH} \longrightarrow \text{PhN}:\text{N}:\text{N}$. On the other hand the formation of PhN_3 from $\text{PhN}(\text{NO})\text{NH}_2$ seems at first an argument against the open chain. But the transposition discovered by Thiele (*C. A.* 5, 457), where the NO group of H_2NNH_2 derivs. migrates from 1 N atom to the other may explain the reaction, thus: $\text{PhN}(\text{NO})\text{NH}_2 \longrightarrow \text{PhNHNHNO} \longrightarrow \text{PhN}:\text{N}:\text{N}$. In the same way the reaction of $\text{PhN}(\text{NO})\text{NH}_2$ in its tautomeric form $\text{PhN}(\text{NH})\text{NOH}$ with HNO_2 , thus: $\text{PhN}(\text{NH})\text{NOH} \longrightarrow \text{PhN}(\text{NNO})\text{NOH} \longrightarrow \text{PhN}:\text{NOH} + \text{H}_2\text{O}$, is analogous to the reaction of HN_3 with HNO_2 , thus: $\text{HN}_3 + \text{HNO}_2 \longrightarrow \text{N}_2 + \text{N}_2\text{O} + \text{H}_2\text{O}$. $\text{PhN}(\text{NH})\text{NOH}$ is representative of a group of compds. which contain quinquivalent N, e. g., PhNO_2 , $\text{PhN}(\text{O})\text{H}_2$ (tautomer of PhHNOH), $\text{PhN}(\text{O})\text{NH}$ (tautomer of PhNNOH), $\text{PhN}(\text{O})\text{NOH}$ (tautomer of $\text{PhN}(\text{NO})\text{OH}$), $\text{PhN}(\text{O})\text{NR}$ (tautomer of $\text{PhN}:\text{N}(\text{O})\text{R}$), $\text{PhN}(\text{NH})\text{NOH}$ (tautomer of $\text{PhN}(\text{NO})\text{NH}_2$), and $\text{PhN}(\text{O})\text{CHR}$ (tautomer of nitrones) and the similarity in behavior of which renders it justifiable to consider the forms above. This similarity is well illustrated by the fact that $\text{PhN}(\text{O})\text{NOH}$ and $\text{PhN}(\text{NH})\text{NOH}$ both form $\text{PhN}:\text{NOH}$. C. C. DAVIS

Action of sulfur on organic compounds. IX. I. SZPERL. *Roczniki Chem.* 6, 728-37 (1926).—*o*- $\text{MeC}_6\text{H}_4\text{CH}_2\text{OH}$, m. 33.7-34.2°, prep'd. from *o*- $\text{MeC}_6\text{H}_4\text{CH}_2\text{Br}$, yields, on heating at 200° with S, *o*- $\text{MeC}_6\text{H}_4\text{CHO}$, *o*- $\text{MeC}_6\text{H}_4\text{CO}_2\text{H}$, probably 2,2'-dimethylstilbene, and a number of unidentified products. (With I. LIEBACH).—*m*- $\text{MeC}_6\text{H}_4\text{CH}_2\text{OH}$ when heated with S yields *m*-methylbenzyl ether, b. 315-21°, *m*- $\text{MeC}_6\text{H}_4\text{CHO}$, *m*- $\text{MeC}_6\text{H}_4\text{CO}_2\text{H}$, 3,3'-dimethylstilbene, and a number of unidentified products. (With F. SZPIC).—*p*- $\text{MeC}_6\text{H}_4\text{CH}_2\text{OH}$, similarly treated, gives *p*- $\text{MeC}_6\text{H}_4\text{CHO}$, *p*- $\text{MeC}_6\text{H}_4\text{CO}_2\text{H}$, 4,4'-dimethylstilbene, and unidentified products. B. C. A.

Cyclic compounds. I. Ethyl 2,3-dimethylbutane-1,1,4,4-tetracarboxylate and some cyclobutane compounds derived therefrom. ISRAEL VOGEL. *J. Chem. Soc.* 1927, 1985-94.—Reduction of $\text{MeCH}:\text{C}(\text{CO}_2\text{Et})_2$ with moist Al-Hg gives 45% of *Et* 2,3-dimethylbutane-1,1,4,4-tetracarboxylate (I), b_{16} 225.6°, d_4^{17} 1.0887, n_D^{17} 1.44873, $[\text{R}_L]_D$ 92.16 (calcd., 91.93); *di-Na* deriv., best prep'd. with MeONa , pale yellow, the free acid consists of a mixt. of the *dl*-acid, m. 185-5.5 (decompn.) and the *meso*-acid, m. 152-4° sep'd. by fractional crystn., the *meso* acid being the more sol. Heating the mixed acid at 200° gives a mixt. of β,β' -dimethyladipic acids, yielding chiefly an acid m. 113-7°. I (50 g.), 6.5 g. Na, 11.3 cc. MeOH and 13.5 cc. Br in 450 cc. Et_2O give 40 g. *Et* 2,3-dimethylcyclobutane-1,1,4,4-tetracarboxylate, b_{16} 208.10°, d_4^{16} 1.1216, n_D^{16} 1.45573, $[\text{R}_L]_D$ 90.16 (calcd., 89.73). Hydrolysis gives the free acid, m. 138-9° (correct analytical results could not be obtained). Heating the acid at 180° and esterification gave a mixt. of *Et* 2,3-dimethylcyclobutane-1,4-dicarboxylate, b_{14} 138-9°, d_4^{16} 1.0095, n_D^{16} 1.43888, $[\text{R}_L]_D$ 59.43 (calcd. 58.72); sapon. and treatment with Et_2O gives the *trans*-acid, m. 200.5-1.5°; heating the mixed acids with AcCl gives the *cis*-anhydride, m. 50-1°; the *cis*-acid, m. 87-8°. The *trans*-anhydride could not be isolated. Distg. of the mixed acids *in vacuo* gives the *cis*-acid and some anhydride. Heating the pure *trans*-acid with AcCl gives the *cis*-anhydride. C. J. WEST

Aromatic sulfofluorides. WILHELM STEINKOPF, KURT BUCHHEIM, KURT BEYTHIEN, HERMANN DUDEK, JOHANNES EISOLD, JOHANNES GALL, PAUL JAEGER, HORST REUMUTH, ALEXIS SEMENOFF AND ARTUR WEMME. *J. prakt. Chem.* 117, 1-82 (1927).— C_6H_6 (55 g.) added to 225 g. FSO_3H at 16-20° during 6 hrs. and then stirred at the same temp. for 9 hrs. gives 62% of benzenesulfofluoride (I), b_{14} 90-1°, b. 203-4°, d_4^{20} 1.3286, n_D^{19} 1.49316; it also results from PhSO_2Cl and FSO_3H after 24 hrs. at room temp. I (2 g.), shaken with 8 cc. concd. NH_4OH 15 min., gives 71% PhSO_2NH_2 ; 4 g. I with 8

g. liquid NH_3 overnight at room temp. gives 92%. I does not react with PhNH_2 after several hrs.' heating at $180-5^\circ$. I does not react with EtOH , even after standing several days; on addn. of alkali at temps. not over 15° , 10 g. I gives 9 g. PhSO_2Et ; 2 g. I and 3 g. PhNHNH_2 after 1 day give 0.8 g. $\text{PhSO}_2\text{NHNHPh}$, m. $154-5^\circ$. I (5 g.) and 5 g. AlCl_3 in 20 g. CS_2 , warmed to 50° , give 5 g. PhSO_2Cl . I (5 g.), 20 g. C_6H_6 and 5 g. AlCl_3 , warmed to $50-5^\circ$, give 40% sulfobenzene. Reduction of 10 g. I with excess of Zn gives only 2 g. PhSH . Nitration of I with fuming HNO_3 and concd. H_2SO_4 gives the *m*-nitro deriv., deep yellow, m. 48° ; reduction with Sn in concd. HCl gives the *m*-amino deriv., m. $29-30^\circ$, b. $297-9^\circ$ (partial decompn.); HCl salt, m. $165-7^\circ$. The SnCl_4 salt, diazotized in the usual manner, gives benzene-1-sulfofluoride-3-diazonium chloride stannichloride, rose, decomp. $155-6^\circ$; the salt couples with $\beta\text{-C}_{10}\text{H}_7\text{OH}$ to give a fiery red dye. The HCl salt, upon being diazotized, gives the light yellow diazoaminobenzene-3,3'-disulfofluoride, m. $175-6^\circ$ (decompn.). Through the diazo reaction there is obtained *m*-iodobenzenesulfofluoride, b_{13-14} 137° ; with Cl (cooling) there results 1-phenyldiochloride-3-sulfofluoride, yellow, m. $98-9^\circ$, which is rather stable. *m*-Cyanobenzenesulfofluoride, m. $69-70^\circ$ (30-40% yield). *m*- $\text{C}_6\text{H}_4(\text{SO}_2\text{Cl})_2$ (15 g.) and 80 g. FSO_3H , heated 19 hrs. at $90-100^\circ$, give 3 g. *m*-benzenedisulfofluoride, m. $38-9^\circ$. PhMe (300 g.) and 1200 g. FSO_3H , 12 hrs. at $20-23^\circ$, give 89% of a mixt. of *o*- and *p*- $\text{MeC}_6\text{H}_4\text{SO}_2\text{F}$, contg. approx. 40% of the *o*-deriv. Fractional distn. or crystn. gives 23% of the pure *p*-deriv. (II), m. $43-4^\circ$, b_{16} 112.5° , b_{22} 121.5° , b_{35} 133.8° , b_{51} 144.9° , b_{67} 151° , b_{182} 169.5° . The *p*-deriv. also results from *p*- $\text{MeC}_6\text{H}_4\text{SO}_2\text{Cl}$ and FSO_3H . II or the mixt. does not react with boiling H_2O during 8 hrs.; with 25% H_2SO_4 the *o*-compd. is hydrolyzed less readily than the *p*-compd. With Me_2NH II gives *p*-toluenesulfondimethylamide, m. $86-7^\circ$. 2-Nitro deriv. of II, pale yellow, m. $48-9^\circ$ (84% yield); 20 hrs.' treatment with liquid NH_3 gives the sulfamide, m. $144-5^\circ$. Reduction with Sn and concd. HCl gives 83% of 2-aminotoluene-4-sulfofluoride, m. $96-7^\circ$; 1c deriv., m. $188.5-9.5^\circ$. Toluene-4-sulfofluoride-2-azo- β -naphthol, bright red, m. 217° . Oxidation of II with CrO_3 in AcOH gives 32% of 4-sulfofluorobenzoic acid, m. 270° ; NH_4 salt; acid chloride, m. $53-3.5^\circ$; *Et* ester, m. $49-9.5^\circ$; amide, m. $187-7.5^\circ$. 3- $\text{ClO}_2\text{SC}_6\text{H}_4\text{CO}_2\text{H}$ and FSO_3H give 58% of 3-sulfofluorobenzoic acid, m. $154-5^\circ$; NH_4 salt, m. $130-2^\circ$; chloride, m. $108-10^\circ$, anhydride, m. $120-2^\circ$, by heating the acid with Ac_2O in $\text{C}_6\text{H}_5\text{Me}_2$ 9 hrs.; amide, m. $100-10^\circ$ (methylamide, m. $145-7^\circ$); *Et* ester, b. $126.5-8.5^\circ$ (methylamide, b. $192-4^\circ$ (high vacuum)); *Pr* ester, b. $118-20$ (high vacuum) (benzylamide, m. $60-1^\circ$); anilide, m. $157-8^\circ$. Nitration of a mixt. contg. 71% *o*- $\text{MeC}_6\text{H}_4\text{SO}_2\text{F}$ gives 4-nitratoluene-2-sulfofluoride (III), m. $57-8^\circ$; with AlCl_3 this gives 4,2- $\text{O}_2\text{N}(\text{SO}_2\text{F})\text{C}_6\text{H}_3\text{Me}$; III does not give ClSO_3H during 20 hrs. at room temp. Reduction of III gives the 4-amino deriv., light yellow, m. 62° (45% yield); *Ac* deriv., m. $120-1^\circ$. Through the diazo reaction there results *o*-toluenesulfofluoride, $b_{66.5}$ 133.9° , b_{88} 146.2° ; heated 3 hrs. with FSO_3H at $130-40^\circ$, there results 48% of toluene-2,4-disulfofluoride, m. $87-8^\circ$. *p*- $\text{C}_6\text{H}_4\text{Me}_2$ and FSO_3H 20 hrs. at 25° give 85% 1,4-dimethylbenzene-2-sulfofluoride, b_{21} $124-5^\circ$, m. $24-5^\circ$; 6-nitro deriv., m. $74-4.5^\circ$ (76% yield); AlCl_3 in CS_2 gives the chloride, m. 61° . *m*- $\text{C}_6\text{H}_4\text{Me}_2$ gives 1,3-dimethylbenzene-4-sulfofluoride (IV), b_{14} $149-50^\circ$, b. $239-40^\circ$; 6-nitro deriv., m. $109-10^\circ$ (80.6% yield); 6-amino deriv., m. $55-6^\circ$ (HCl salt, decomp. $191-6^\circ$). Heating IV with FSO_3H at 100° for 5 hrs. gives 69.6% of 1,3-dimethylbenzene-2,4-disulfofluoride, m. $116-7^\circ$. Mesitylenesulfofluoride, m. $73-3.5^\circ$, b_{12} 125° ; nitro deriv., m. $58-9^\circ$. Mesitylenedisulfofluoride, from the sulfofluoride and ClSO_3H , m. $121.5-2.5^\circ$; disulfamide, m. $240-1^\circ$. Pseudocumenesulfofluoride, b_{12} $123-6^\circ$, b_{20} $137-9^\circ$; nitro deriv., b_{14} $163-4^\circ$. 1,3-Dimethyl-5-*tert*-butylbenzenesulfofluoride, m. $115-6^\circ$; dinitro deriv., m. $127-8^\circ$, whose chloride m. $139.5-40.5^\circ$. α -Naphthalenesulfofluoride (V), m. 56° , from 250 g. C_{10}H_8 in 600 g. H_2SO_4 and 400 g. FSO_3H (65 g. yield); also from $\text{C}_{10}\text{H}_8\text{SO}_3\text{Na}$ and FSO_3H . β -Naphthalenesulfofluoride (VI), m. $87-8^\circ$. C_{10}H_8 (25 g.) and 100 g. FSO_3H , 6 hrs. at $70-80^\circ$, gives a disulfofluoride, m. 125° , which yields a disulfochloride, m. 118° . V, allowed to stand 24 hrs. with FSO_3H , either at room temp. or at 100° gives a mixt., from which Et_2O or PhMe exts. naphthalene-1,5-disulfofluoride, m. 203° ; the disulfamide does not m. 340° . V, gradually added to ClSO_3H , gives naphthalene-1-sulfofluoride-5-sulfochloride, m. 174° ; the Et_2O soln., satd. with NH_3 , gives the 5-sulfamide, m. $252-3^\circ$. VI (1 part), gradually added to 2.4 parts ClSO_3H , gives naphthalene-2-sulfofluoride-6-sulfochloride, m. $114-6^\circ$; 6-sulfamide, m. 208° . Tetralin (180 g.) and 730 g. FSO_3H , 12 hrs. at $15-20^\circ$, give 12-16% of 1-tetralinsulfofluoride, m. $75-7^\circ$; nitro deriv., m. $108-9^\circ$ (methylamide, m. $169-71^\circ$); with AlCl_3 in CS_2 there results an addn. comp. of the fluoride and chloride, $\text{C}_{20}\text{H}_{20}\text{O}_2\text{N}_2\text{FClS}_2$, m. $87-8^\circ$; amino deriv., decomp. $226-7^\circ$ (HCl salt, m. $83-4^\circ$); cyano deriv., m. $113-6^\circ$. PhOH (25 g.) in 30-40 g. CS_2 , added to 100 g. FSO_3H at room temp., gives 27 g. *p*-phenolsulfofluoride (VII), m. 77° ; this also results from *p*- $\text{HOC}_6\text{H}_4\text{SO}_3\text{Na}$ and FSO_3H ; with NH_3 in Et_2O it gives the NH_4 salt, sinters 120° .

30°, m. 200–3°; after standing 0.5 yr., there is formed a small amt. of *phenyl-p-sulfonyl-*ide, m. 276–7°, also formed when an aq. soln. of the salt stands several days. VII and liquid NH₃, 3 days at room temp., give *di-p-phenolsulfonamide*, (*p*-HOC₆H₄SO₂)₂NH, m. 154–5°. VII and 33% EtOH-MeNH₂ give *p-phenolsulfonmethylanilide*, m. 81–2°; the *dimethylanilide*, m. 95–6°. VII and PhNH₂, heated 1 hr. on the H₂O bath, give the *PhNH₂ salt of p-phenolsulfanilide*, m. 112–3°. VII, AlCl₃ and C₆H₆ give *p-hydroxydiphenylsulfone*, m. 131°. PhOH gives *p,p'-dihydroxydiphenylsulfone*. Nitration of VII or the action of *o*-C₆H₄NC₆H₄OH and FSO₃H gives the *2-nitro deriv.*, m. 66–7°; *2-amino deriv.*, m. 131° (*HCl salt*, m. 203–5° (decompn.); *formyl deriv.*, m. 241–2°). Heating 25 g. VII and 100 g. FSO₃H 3 hrs. at 100° gives 30% of *2,4-phenoldisulfofluoride*, m. 120–1°; *NH₄ salt*, m. 184–5°, decomps. 188°. *6-Nitro deriv.*, m. 98.5–9.5° (68% yield); *6-amino deriv.*, m. 119–20°. *Phenol-2,4-disulfanilide*, m. 203–4°; FeCl₃ gives a ruby-red color. *Phenol-2-sulfochloride-4-sulfofluoride*, m. 75–6°; *2-sulfamide*, m. 175–5.5°; *2-sulfoluide*, m. 147–8°. *Phenol-2,4-disulfamide*, m. 239–40°. *p-HOC₆H₄Me* and FSO₃H in CS₂ at 20° give 36% of *4-hydroxy-1-methylbenzene-3-sulfofluoride*, b₂₀ 135–6°, m. 58–9° (*NH₄ salt*); excess liquid NH₃ gives the *3-sulfamide*, m. 151–2°. Warming with dil. HNO₃ gives 4,3,5-HO(O₂N)₂C₆H₂Me, m. 85°; with HNO₃ and H₂SO₄ at –10° there results 85% of the *6-nitro deriv.*, m. 87–8°; *6-amino deriv.*, analyzed as the *HCl salt*, 4,3-HO(KO₂S)C₆H₂Me (20 g.) and 85 g. FSO₃H, heated 2 hrs. at 80–90°, gives 8.9 g. of the *K salt*, brownish white, of *4-hydroxy-1-methylbenzene-3-sulfofluoride-5-sulfonic acid*, crystg. with 2.5 mols. H₂O, m. 120–1°; *NH₄ salt*, decomps. 265°. *5-Bromo-p-cresol-3-sulfofluoride*, m. 75°; *NH₄ salt*, m. 193–6°; *3-sulfodichthylamide*, m. 102–3°. *2,6-Diiodophenyl-4-sulfofluoride*, m. 132°; *NH₄ salt*, m. 208–10°. *o-Cresol-sulfofluoride*, m. 56–7° (8% yield); *NH₄ salt*; *nitro deriv.*, light yellow, m. 60–0.5°. *m-Cresol-sulfofluoride*, b₁₁ 169–70°, m. 49–50.5°; *di-m-cresolsulfonamide*, m. 154–6°. *p-Anisolesulfofluoride*, b₆₀ 175°, m. 13° (22% yield); *2-nitro deriv.*, m. 78.5°; *2-amino deriv.*, m. 66° (*HCl salt*, m. 202°). *p-Phenolesulfofluoride*, m. 38°; *2-nitro deriv.*, m. 73°. *2-Naphthol-3,6-disulfochloride*, m. 112–3°; PhNH₂ gives the *6(or 3)-sulfanilide*, m. 138–9°. *2-Naphthol-3,6-disulfofluoride* (VIII), m. 108–9.5°; *NH₄ salt*, yellow. In the prepn. from *β*-C₁₀H₇OH, there is also formed the *2-naphtholsulfonate of VIII*, m. 265° (decompn.). VIII heated with FSO₃H 16 hrs. at 115–30°, gives *2-naphthol-3,6,8-trisulfofluoride*, (IX), m. 153–9°. VIII and 33% Me₂N soln. give *2-naphthol-3,6-disulfontetramethylamide*, m. 159–60.5°. *2-Naphthol-6,8-disulfofluoride*, m. 175–6°, from *G salt* and FSO₃H; *NH₄ salt*, does not m. 240°. *R salt* gives IX. *2-Hydroxy-5-sulfofluoridebenzoic acid*, m. 183° (36% yield); *NH₄ salt*, decomps. 190°; *Ac deriv.*, m. 149°; *Me ether*, m. 107–8°.

C. J. WEST

Bromophenols. XXII. Several halogenated phenols prepared from *o*-chlorophenol. MORITZ KOHN AND J. J. SUSSMANN. *Monatsh.* 48, 193 202(1927); cf. C. A. 21, 574. 2,4,6-Cl(Br)₂C₆H₂OH is reduced to 2,4-ClBrC₆H₂OH (I) by Zn and AcOH upon boiling for 1.5 hrs.; it is characterized by its 6-NO₂ deriv., m. 195°. *o*-ClC₆H₄OH with Me₂SO₄ and NaOH gives *o*-ClC₆H₄OMe, b₇₆₁ 194–200°; with PBr₃ this gives *2-chloro-4-bromoanisole*, b₇₄₉ 241–8°, m. 70°, demethylated to I by 66% HBr. I (10 g.) in 50 cc. H₂O and 5.8 g. NaOH, diluted to 300 cc. and treated with 18 g. I and 23 g. KI in 30 cc. H₂O, gives *2-chloro-4-bromo-6-iodophenol*, m. 70°; the corresponding *anisole*, m. 39°. *o*-ClC₆H₄OH (20 g. suspended in 5 l. H₂O) treated with 70 g. Br and 200 g. KBr in 500 cc. H₂O gives *2-chloro-4,6-dibromophenol bromide*, oxidized by fuming HNO₃ to 2,6-chlorobromiquinone; reduction with H₂SO₄, methylation and nitration give *2-chloro-6-bromo-3,5-dinitrohydroquinone di-Me ether* (II), m. 135°, rhombic, *a:b:c* = 0.89439:1:1.61023 (other crystallographic data given); boiling with C₆H₅N and decompn. of the salt with 20% KOH give the *mono-Me ether*, m. 124°, yellow monoclinic prisms, *a:b:c* = 1.13723:1:0.93586, *β* 94° 22.9'. II is also obtained from 2,4-Cl₂C₆H₂OH by the same series of reactions as from *o*-ClC₆H₄OH. XXIII. Diphenyl ether of 2,5-dihydroxyquinol and related compounds. *Ibid* 203–10.—Bromoanil, gently boiled 0.75 hr. with Zn and AcOH gives 2,5,4-Br₂(AcO)C₆H₂OAc, m. 165°; this also results from tribromoquinone, Zn and AcOH. Bromoanil and PhOK in H₂O, heated 0.5 hr. on the H₂O bath and the crude ether boiled 2 hrs. with Zn and AcOH, give 2,5-diphenoxyquinone, yellow, m. 236°; if this is heated further with Zn and AcOH until the soln. is completely decolorized, there results 2,5-diphenoxyhydroquinol, m. 128° (*diacetate*, m. 148°); Me₂SO₄ gives the 1,4-di-Me 2,5-di-Ph ether of 1,2,4,5-C₆H₂(OH)₄, m. 147°. 2,5,3,6-Br₂(NaO)₂C₆H₂, boiled 2 hrs. with Zn and Ac₂O, and the resulting product again treated in the same way, gives 1,2,4,5-tetraacetoxybenzene, m. 226°. Dibromotoluquinone is likewise reduced by Zn and Ac₂O to dibromotoluhydroquinone diacetate, m. 140°. XXIV. Dehalogenation of bromophenols. M. KOHN AND JULIUS PFEIFER. *Ibid* 211–20.—Reduction of 2,4,6-Br₃C₆H₂OH by an equal wt. of Zn dust and 4 parts AcOH by heating

97 min. gives 60% of 2,4-Br₂C₆H₃OH, whose Me ether *b*₇₄₄ 258-62°, m. 62-4° and whose benzoate, m. 92°; the 6-nitro deriv. m. 118.5° (crystallographic data given). An improved method is given for the prepn of Br₃C₆OH; reduction of this with Zn and AcOH gives 3,4,6-tribromophenol (I), m. 79°, benzoate, m. 99°. Me₂SO₄ and 10% KOH give 3,4,6-tribromoanisole, *b*₇₃₃ 306-9°, m. 105°; 2-nitro deriv., yellow, m. 70°; fuming HBr gives 3,4,6-tribromo-2-nitrophenol, m. 122°. Bromination of I gives 2,3,4,6-Br₄C₆HOH, m. 114°, oxidized by fuming HNO₃ to tribromoquinone, yellow, m. 150°. I is chlorinated by 1 mol Cl₂ diluted with CO₂, giving the 2-Cl deriv (II), m. 101°; Me ether, m. 82°; benzoate, m. 112°. 3,4,6-Tribromo-2-chloro-5-nitroanisole, m. 114°; fuming HBr gives the 3,4,6-tribromo-2-chloro-5-nitrophenol, m. 156°. II is also formed by reducing 2,3,4,6-Br₄C₆HOH with Zn and AcOH (70% yield). Tribromoresorcinol with Zn and Ac₂O gives 4,6-dibromoresorcinol diacetate, m. 94°. 4,5-Dibromopyrocatechol diacetate, m. 173°. XXV. Halogenation of chlorophenols. *Ibid* 231 41.--2,3,4,6-Cl₄C₆HOMe, *b*₇₄₄ 266-70°, m. 60°, yields a 5-nitro deriv., m. 58°; fuming HBr gives 2,3,4,6-tetrachloro-5-nitrophenol, m. 122°. 2,3,4,6,5-Cl₅BrC₆OH, m. 197°, d. 2.287, monoclinic prismatic crystals, *a*·*b*·*c* = 2.3615 1.3.09882, *β* 108° 57' 9". 3,5-Cl₂-C₆H₃OH and Br give 3,5,2,4,6-Cl₅Br₂C₆OH (I), m. 183°, triclinic, *a*·*b*·*c* = 0.47145:1:0.32873, *α* 86° 44' 5", *β* 102° 10' 18", *γ* 92° 44' 10". 3,5-Dichloro-2,4,6-tribromoanisole, *b*₇₄₄ 349 50°, m. 149 50°. Oxidation of I with fuming HNO₃ gives 2,6-dichloro-3,5-dibromoquinone, yellow, does not m. 260°. 3,5-Dichloro-2,4,6-triiodophenol, decomp. 185°. m. 205°; Me ether, m. 197°; oxidation gives 3,5-dichloro-2,6-diiodoquinone, red, m. 240° (decompn.). 1-Acetyl-2,4-dinitro-3,5-dichlorobenzene, yellow, m. 124 5°; PhNH₂ gives the 3,5-dianilino deriv., red, m. 235°. XXVI. 2,4,6-Trichloro-3-bromophenol and 2-chloro-4,6-dibromophenol. M. KOHN and FANNY RABINOWITSCH. *Ibid* 347-60 --2,1,6-Cl₃C₆H₂OH with Br-KBr gives trichlorophenol bromide (I), rearranged by heating with concd. H₂SO₄ on the H₂O bath to 2,4,6-trichloro-3-bromophenol, m. 76° (cor.), purified through the Me ether (II), *b*₇₄₁ 285 90°, m. 64 5° (cor.); Bz deriv., m. 117°. Oxidation of I gives 2,6-dichloroquinone II and fuming HNO₃ give 2,4,6-trichloro-3-bromo-5-nitroanisole, m. 74°; HBr gives the corresponding phenol, m. 131°. 2-Chloro-4,6-dibromoanisole (III), *b*₇₃₉ 269 72°, m. 75°, d. 2.213, monoclinic, *a*·*b*·*c* = 2.04550:1:3.20181, *β* 92° 35' 20". 2,4,6-Cl₃C₆H₂OMe forms monoclinic needles, d. 1.640, *a*·*b*·*c* = 2.01105 1.3.1917, *β* 92° 58' 25". 2-Chloro-4,6-dibromo-3(or 5)-nitroanisole, m. 73°, from 6 g. III and 50 cc. fuming HNO₃ at room temp.; from 13 g. III and 130 cc. fuming HNO₃ on adding to the soln. 70 80 cc. concd. H₂SO₄, there results 4,6-dibromo-2-chloro-3,5-dinitroanisole, m. 128-9°; the corresponding phenol, m. 180-1°. *o*-ClC₆H₄OH (5 g.) and 3.5 g. NaOH in 200 cc. H₂O, treated with 20 g. I and 20 g. KI in 100 cc. H₂O, give 2.5 g. 4,6-diiodo-2-chlorophenol, m. 96°; Me ether, m. 65°, monoclinic (crystallographic data given). Dibromo-*o*-chlorophenol bromide, heated with concd. H₂SO₄, gives a tribromo-*o*-chlorophenol, m. 96°, which may be a mixt. of 2,4,5,6-ClBr₃C₆HOH and 2,3,1,6-ClBr₃C₆HOH, Me ether, *b*₇₃₇ 320-5°, m. 87°. Oxidation of the bromide gives 2-chloro-6-bromoquinone, golden yellow, m. 113 4°. XXVII. Dibromo-*o*-cresol resulting from the action of aluminum chloride and benzene upon tetrabromo-*o*-cresol. *Ibid* 361 74 --4,6-Dibromo-3,5-dichloro-*o*-cresol, m. 196-7°, by chlorination (Cl₂ + CO₂) of 4,6,2-Br₂(HO)C₆H₂Me, Me ether, m. 115 6°; oxidation gives 4,6-dibromo-3-chlorotoluquinone, yellow, m. 231°. 4,6-Dibromo-3,5-diiodo-*o*-cresol, m. 176-7°; Me ether, m. 141°; oxidation gives 4,6-dibromo-3-iodotoluquinone, reddish yellow, m. 216-7°. 4,6-Dibromo-*o*-methoxytoluene, *b*₇₄₁ 268 72°; nitration with HNO₃ and H₂SO₄ gives the 3,5-dinitro deriv., m. 111 2°; the corresponding cresol, m. 165°. 4,5,6-Tribromo-3-iodo-*o*-cresol, m. 180-2°, Me ether, m. 139°. The 3-chloro deriv., m. 209-11°. Me ether, *b*₇₃₇ 345 8°, m. 128°. 4,6-Dibromo-5-chloro-*o*-cresol (I), m. 112-3°; Br gives 3,4,6-tribromo-5-chloro-*o*-cresol (II), pale brown, m. 197 8°; oxidation gives tribromotoluquinone, yellow, m. 232°. The Me ether of I *b*₇₃₁ 300-12°, m. 232°; of II, m. 132°. 4,6-Dibromo-3-iodo-5-chloro-*o*-cresol, rose, m. 169 70°; Me ether, pale rose, m. 124°.

C. J. WEST

Condensation of chloral with phenol. F. D. CHATTAWAY AND A. A. MORRIS. *J. Chem. Soc.* 1927, 2013 7; cf. *C. A.* 21, 233. PhOH (100 g.) added to 1000 cc. cooled H₂SO₄ (d. 1.8) and after an hr. treated with 400 g. chloral hydrate, gives 150 g. anhydro-2-β,β-trichloro-α-hydroxyethylbenzene-1-β,β,β-trichloro-α-hydroxyethylbenzene-5-sulfonic acid (I), crystg. with 3H₂O, of which 2 are lost at 110° after 0.5 hr., m. 150-66° (decompn.); NH₄ salt, prisms. Nitration of I gives anhydro-3,5-dinitro-2-β,β,β-trichloro-α-hydroxyethylbenzene, sepg. 1st as a labile form, silky needles, changing in contact with the mother liquor to stable, pale yellow rhombohedra; both forms m. 163°; the position of the 2nd NO₂ group was established by the formation with EtOH-KOH of ω,ω-dichloro-3,5-dinitro-2-ethoxyacetophenone, yellow, m. 82-4° (osa-

zone, orange, m. 224°). I and PCl_5 give the *sulfonyl chloride*, m. 130.5°; MeOH gives the *Me ester*, m. 150°; *Et ester*, m. 143°; *amide*, m. 207°; *dichloroamide*, m. 165–74° (decompn.); *anilide*, m. 188.5°.

C. J. WEST

Some physical properties of Nitrophenols. LOUIS DESVERGNES. *Rev. chim. ind.* **36**, 194–6, 224–6 (1927); cf. *C. A.* **19**, 2036, 3257; **20**, 2325; **21**, 740.—*o*- $\text{O}_2\text{NC}_6\text{H}_4\text{OH}$ solidifies at 45.13° (dtd. in air-jacketed tube); soly. at 15.5° in AcOEt 130.95, Me_2CO 69.14, MeOH 11.83, 96% EtOH 25.31, abs. alc. 24.55, C_6H_6 107.38, CHCl_3 99.68, Et_2O (anhyd.) 95.03, $\text{C}_6\text{H}_5\text{N}$ 144.44, CS_2 47.59, CCl_4 40.42, C_7H_8 45.28. Crystals obtained from the soln. in $\text{C}_6\text{H}_5\text{N}$ m. 44.8–45°, showing that no compd. is formed. *p*- $\text{O}_2\text{NC}_6\text{H}_4\text{OH}$ solidifies at 113.61° (dtd. in air-jacketed tube); soly. (at 14° except with H_2O) in H_2O at 15° 0.804, in H_2O at 50° 0.052, in AcOEt 126.16, Me_2CO 205.08, MeOH 240.45, EtOH (96%) 160.90, abs. alc. 150.92, C_6H_6 1.276, CHCl_3 2.990, anhyd. Et_2O 130.35, $\text{C}_6\text{H}_5\text{N}$ 71.20, CS_2 0.052, CCl_4 0.050, C_7H_8 1.126. It dissolves in $\text{C}_6\text{H}_5\text{N}$ with slight rise in temp. and immediate pptn. of very fine light-yellow needles, m. 48–50°, slightly sol. in boiling H_2O , very sol. in cold EtOH and in cold C_6H_6 . 2,4-(O_2N) $_2$ - $\text{C}_6\text{H}_3\text{OH}$ solidifies at 112.50° (dtd. in air-jacketed tube), m. 113.1° (Maquenne block); soly. (at 15° and 50° except with H_2O) in H_2O at 12.5° 0.0202, at 50° 0.0802, at 85° 0.6286, at 100° 1.3188; in AcOEt 15.548, 39.49; Me_2CO 35.899, 98.33; MeOH 4.976, 16.92; 96% EtOH 3.046, 11.32; abs. alc. 3.767, 13.29; C_6H_6 6.386, 25.67; CHCl_3 5.593, 19.83; anhyd. Et_2O 3.065, 7.19; $\text{C}_6\text{H}_5\text{N}$ 20.081, 67.98; CS_2 0.407, 1.02 (at 34.5°); CCl_4 0.423, 1.78; C_7H_8 6.363, 19.98. When it is brought in contact with $\text{C}_6\text{H}_5\text{N}$ there is a rise in temp. with formation of canary-yellow crystals, m. 71.5°, sol. in hot H_2O , 95% EtOH and C_6H_6 , above 71.5° loses 30.3% in wt. with regeneration of (O_2N) $_2$ - $\text{C}_6\text{H}_3\text{OH}$, showing it is (O_2N) $_2$ - $\text{C}_6\text{H}_3\text{OH}$. 2,6-(O_2N) $_2$ - $\text{C}_6\text{H}_3\text{OH}$ solidifies 61.53° (dtd. in air-jacketed tube); soly. (at 14° except with H_2O) in H_2O at 15° 0.0315, at 50° 0.5121, at 100° 1.2200, in AcOEt 68.805, in Me_2CO 162.209, MeOH 14.735, 96% EtOH 6.502, abs. alc. 5.496, C_6H_6 33.654, CHCl_3 31.845, anhyd. Et_2O 8.761, $\text{C}_6\text{H}_5\text{N}$ 68.038, CS_2 0.673, CCl_4 0.690, C_7H_8 28.297. Evapn. *in vacuo* of the $\text{C}_6\text{H}_5\text{N}$ soln. gives orange-red crystals, m. 44.5°, slightly sol. in H_2O , very sol. in alc. and C_6H_6 . 2,4,6-(O_2N) $_3$ - $\text{C}_6\text{H}_2\text{OH}$ solidifies at 121.60° (dtd. in air-jacketed tube); soly. (at 16° and 50° except with H_2O) in H_2O at 9° 0.979, at 50° 2.328, at 82° 4.691, at 100° 7.600; in AcOEt 39.410, 68.48; in Me_2CO 123.299, 220.53; MeOH 15.951, 40.25, 96% EtOH 9.201, 20.69; abs. alc. 6.831, 19.72; C_6H_6 7.493, 29.45; CHCl_3 2.025, 5.67; anhyd. Et_2O 2.638, 3.96; $\text{C}_6\text{H}_5\text{N}$ 27.619, 58.94; CS_2 0.107, 0.18 (at 34°); CCl_4 0.065, 0.35; C_7H_8 12.242, 27.84. When $\text{C}_6\text{H}_5\text{N}$ is brought into contact with picric acid there is a slight rise in temp. with formation of canary-yellow (O_2N) $_3$ - $\text{C}_6\text{H}_2\text{OH}$. 2,3,4,5,6- $\text{C}_6\text{H}_2\text{N}_3$, m. 144.5°.

A. PAPINEAU-COUTURE

Nitro derivatives of the homoprocatechol ethers. A. E. OXFORD. *J. Chem. Soc.* **1927**, 1964–72.—2,4-MeO(Me) $\text{C}_6\text{H}_3\text{OAc}$ (32.2 g.) and 35 cc. AcCl in 140 cc. CCl_4 in a freezing mixt., treated during 2.5 hrs. with 36 g. powdered AgNO_3 , give 5 g. of a liquid b_{10} up to 167° (I), 8 g. b_{10} 167–77° (II) and 5 g. of a solid, b_{10} 177–210°; I and the liquid part of II, hydrolyzed and distd. with steam, give 6(?)-chlorocresol, m. 71°; *Ac deriv.* m. 61°; *Me ether*, m. 37–8°. The part not volatile with steam is a mixt. of 6-nitrocresol and the 2-nitro deriv., which does not solidify at –15°; the Bz deriv. does not cryst.; the *p*-nitrobenzyl ether (2-nitro-3-methoxy-4-*p*-nitrobenzyltoluene), m. 114–4.5°; the corresponding 6-nitro deriv., pale yellow, m. 202–3°. 2,5-Dinitrocresol, yellow, m. 86–7° (25% yield); *Ac deriv.*, m. 53–4°. With Me_2SO_4 and K_2CO_3 in $\text{C}_6\text{H}_5\text{Me}$ there results 2,5-dinitrohomoveratrole, m. 36°. 2-Nitrohomoveratrole may be obtained by methylating the mixt. of 2- and 6-nitrocresol and distg. with steam, then fractionating repeatedly *in vacuo*. Boiling 6-nitrohomoveratrole with KOH soln. gives 6-nitroisocresol, pale yellow, m. 168–70°; Na salt, bright yellow; *Ac deriv.* (III), pale yellow, m. 98–8.5°. 6-Bromo-2-nitrohomoveratrole, m. 102–3°. Nitration of III, followed by hydrolysis, gives 5,6-dinitroisocresol, very pale yellow, m. 128–9°; Na salt, orange-yellow; FeCl_3 gives a brownish red color. The nitration of 2,6-Me(MeO) $\text{C}_6\text{H}_3\text{OAc}$ gives chiefly the 4- NO_2 deriv.

C. J. WEST

Displacement of bromine accompanying the nitration of 6-bromohomoveratrole. TOM HEAP, T. G. H. JONES and ROBT. ROBINSON. *J. Chem. Soc.* **1927**, 2021–2.—Attempts to prep. a mono- NO_2 deriv. of 6-bromohomoveratrole (I) according to Jones and Robinson (*C. A.* **12**, 135) give only 6-nitrohomoveratrole (II) (36% yield); the compd., m. 121°, may have been 4-bromo-5-nitroveratrole (III). Reduction of 100 g. vanillin with Zn-Hg and HCl gives 60 g. cresol, converted into homoveratrole (91%) and then into I (94%); oxidation with KMnO_4 gives 6-bromoveratric acid, m. 183–4°. By the method of Pollecoff and Robinson (*C. A.* **12**, 2314) II is hydrolyzed almost quant. to 6-nitroisocresol in 73 hrs.; it m. 168–70°; *Ac deriv.*, m. 100–1°; methylation gives II. In the bromination of Me veratrate in cold AcOH the yield of the 6-Br

deriv. is not satisfactory. Pure 6-bromoveratric acid and cold HNO_3 give 50% of **III**, m. 121-2°; **III** prepd. from bromoveratrole had the same m. p. C. J. WEST

Preparation and hydrolysis of the isomeric β -tolylethyl bromides. J. B. SHOE-SMITH AND R. J. CONNOR. *J. Chem. Soc.* 1927, 1768-72. — β -o-Tolylethyl bromide (**I**), from the alc. and PBr_3 in C_6H_6 , b₁₀ 99-100°; *m*-isomer (**II**), b₁₁ 101-3°; *p*-isomer (**III**), b₁₁ 103.5-5°. The bromides were stable to aq. EtOH at 76° for 4 hrs. and toward aq. AcOH-HI . Differences in the rate of hydrolysis by aq.-alc. KOH have been observed, the order being: $\text{PhCH}_2\text{CH}_2\text{Br}$ (1.25) > **II** (0.83) > **III** (0.7) > **I** (0.6); the figures in parens. denote the reciprocal of the time for half-hydrolysis of the bromide at 76°.

C. J. WEST

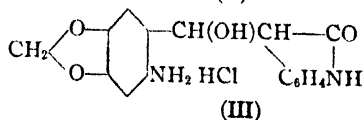
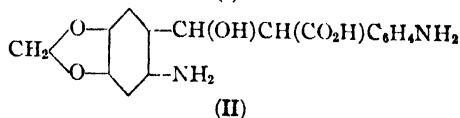
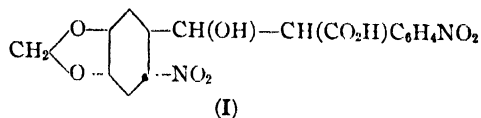
Behavior of aldehyde acetals upon reduction according to Sabatier and Senderens (formation of ethers from acetals). FRITZ SIGMUND AND GERHARD MARCHART. *Monatsh.* 48, 267-88(1927). — The catalytic reduction of $\text{PhCH}(\text{OEt})_2$ with Ni at 180° gives 45% of PhCH_2OEt . Phenylacetaldehyde dimethylacetal, b. 219-21° (cor.) (84% yield), upon reduction, gives 50% $\text{PhCH}_2\text{CH}_2\text{OMe}$. $\text{C}_6\text{H}_{13}\text{CH}(\text{OEt})_2$ gives 61% of $\text{C}_6\text{H}_{13}\text{CH}_2\text{OEt}$. Enanthal dipropylacetal, b₉ 112.5° (97% yield), is reduced to $\text{C}_6\text{H}_{13}\text{CH}_2\text{OPr}$, b. 187.6° (64% yield); the diisobutylacetal, b₁₀ 126.6° (cor.) (92% yield), gives on reduction 64% of heptyl isobutyl ether, b. 194-6°. Phenylacetaldehyde dipropylacetal, b₁₁ 129-31° (71% yield); reduction gives 80% of phenylethyl propyl ether, b. 225-7°. $\text{PhCH}:\text{CHCH}(\text{OEt})_2$ gives $\text{PhCH}_2\text{CH}_2\text{CH}_2\text{OEt}$, b. 220-2°.

C. J. WEST

α -Bromo and hydroxyaldehydes. RUDOLF DWORZAK AND PAULA PFIFFERLING. *Monatsh.* 48, 251-66(1927). — The action of 2 atoms Br upon $(\text{EtCHO})_3$ at -5° to -10° and treatment with EtOH gives about 30% $\text{MeCHBrCH}(\text{OEt})_2$ (**I**), b₉ 69° and about 15% of the dibromoacetal, together with considerable high-boiling material. The action of 4 atoms Br (320 g.) upon 58 g. $(\text{EtCHO})_3$ gives 20 g. pure **I** and 87 g. dibromoacetal (**II**), $\text{MeCBr}_2\text{CH}(\text{OEt})_2$, b₉ 91°. The high boiling fraction, b₂₋₃ 130°, analyzes for $\text{C}_8\text{H}_{16}\text{O}_2\text{Br}_3$, may be $\text{MeCHBrCHBrCMcBrCH}(\text{OH})\text{OEt}$. The action of 2 atoms Br upon 1 mol. $\text{C}_6\text{H}_{13}\text{CHO}$ and treatment with EtOH gives 60% of a mixt. of about 1 part α -bromocanthole, b₂ 62° and about 2 parts of the acetal, b₁ 92°. Heating **I** with twice its wt. of H_2O a short time gives lactaldehyde, which may be extd. with Et_2O after addn. of a little alkali. It was identified as the osazone; the phenylhydrazone could not be obtained. **II** behaves similarly toward H_2O , but the reaction is much slower; AcCHO was identified as the osazone, m. 145°. Similarly was prepd. α -hydroxyenanthole, m. above 100° (not sharply), which is the dimeric form, as shown by mol. wt. detns.

C. J. WEST

Condensation of *o*-nitrophenylacetic acid with 6-nitropiperonal. N. KISHI. *J. Pharm. Soc. Japan* No. 545, 571-4(1927); cf. *C. A.* 21, 2259. — Heating 4,6-nitropiperonal, 4.2 g. $\text{o-O}_2\text{NC}_6\text{H}_4\text{CH}_2\text{CO}_2\text{Na}$ and 50 cc. Ac_2O for 5.5 hrs. gives α -(*o*-nitrophenyl)- β -(3,4-methylenedioxy 6-nitrophenyl)hydroxypropionic acid (**I**), yellow, m. 271°. *Na* salt, colorless; methyl ester, yellow, m. 157°. With FeSO_4 and NH_4OH gives β -hydrazonyl-2-amino-3,4-methylenedioxyphenyl)- α -*o*-aminophenylpropionic acid (**II**), decomps. 210°; with excess HCl gives the HCl salt of 2-aminopiperonylhydroxyindolylcarbinol (**III**), colorless, blackens at 360°.



NAO UYEI.

Catalytic hydrogenation of aromatic acids and their salts. V. N. IPAT'EV AND G. A. RAZUVAYEV. *J. Russ. Phys.-Chem. Soc.* 58, 122-8(1926); cf. *C. A.* 20, 1798; 21, 235. — The hydrogenation of Li , Ca , Ba , Zn , ferrous and Ni benzoates, as also of the Na salts of salicylic, *p*-hydroxybenzoic, and mandelic acids, was carried out by Ipat'ev's

method (C. A. 2, 1958) in the solid state, Ni_2O_3 being used as catalyst. The alkali and alk.-earth salts hydrogenated smoothly and rapidly, giving a 60–70% yield of hexahydrobenzoic acid, but the ferrous, Ni and Zn salts decompd. with the formation of an orange sublimate. The residual gas contained more than 90% of H. Salicylic and *p*-hydroxybenzoic acids gave 80% yields of cyclohexanol, through loss of the carboxyl group. The residual gas contained much CH_4 . Mandelic acid gave, with decompn., a 40% yield of phenylacetic acid, with traces of cyclohexylacetic acid, *i. e.*, in this case it is the OH group which is removed. B. C. A.

Carbalthionic acids and esters. III. Carbithionic acids and esters. Y. SAKURADA. *Mem. Coll. Sci. Kyōto* 10, 79–83(1926); cf. C. A. 21, 2458; 6, 487.—By passing dry H_2S into an ethereal soln. of the corresponding thio-iminoesters the following carbithionic esters were prepd.: Et dithioacetate, b. 128–32°, d_4^{28} 0.9807, n_D^{28} 1.5303; Et dithiopropionate, b. 150–5°, d_4^{27} 0.9711, n_D^{27} 1.5259, η^{27} 2.1535; ethyl dithiobenzoate, b. 122–5°; ethyl dithiophenylacetate, b. 140–44°, d_4^{29} 1.0462, η^{29} 2.9831; ethyl dithio-*p*-toluate, b. 160–5°, d_4^{27} 1.0085, η^{27} 2.3215; ethyl dithio- β -naphthoate, b. 200–5°; diethyl tetrathionoxalate, b. 90–3°. By hydrolysis of these esters with alc. KOH, dithioacetic, dithiopropionic, dithiobenzoic, dithiophenylacetic, dithio-*p*-toluic, and tetrathionoxalic acids were isolated. B. C. A.

Condensation product of vanillin and salicylaldehyde with acetone and the mechanism of this condensation. ERHARD GLASER and ERWIN TRAMER. *J. prakt. Chem.* 116, 331–46(1927).—Vanillylaceton (3 g.) in 10 cc. 96% EtOH and 25 cc. 10% NaOH, treated dropwise with 2 g. *o*- $\text{HOC}_6\text{H}_4\text{CHO}$, gives 50–60% salicylidenevanillylaceton, m. 155° (decompn.); *di*-Ac deriv., m. 149°; *di*-Bz deriv., m. 175–6°. A by-product of this reaction is the compd. $\text{C}_{17}\text{H}_{14}\text{O}_3$, m. 152° (decompn.), probably dihydroxydibenzalacetone. Vanillin (6 g.) and 2 cc. Me_2CO in 25 cc. HCl (d. 1.19) give 60% of divanillylaceton, orange, crystg. with 1 H_2O , m. 155–6°; in alkali it gives an intense bluish red color, visible in a diln. of 1:10,000,000; *di*-Ac deriv., m. 182°; *di*-Bz deriv., 192°; *di*-Ac tetra-Bz deriv., m. 159–61°. Bromovanillylaceton, yellow, m. 147–8°; Ac deriv., m. 135–6°; Na salt. C. J. WEST

The rearrangement of phenyl acetate into *p*-hydroxyacetophenone. V. I. MINAEV. *J. Russ. Phys. Chem. Soc.* 58, 729–36(1926).—Nenzki and Stoeber (*Ber.* 30, 1769(1897)) obtained only 21% of *p*- $\text{HOC}_6\text{H}_4\text{Ac}$, probably because of a no. of mutually interfering reactions. By dropping AcCl (a slight excess) into dil. PhOMe in CS_2 in presence of 1.5 equivs. of AlCl_3 , M. obtained a 62% yield of *p*- $\text{MeOC}_6\text{H}_4\text{Ac}$, from which not more than 20% of *p*- $\text{HOC}_6\text{H}_4\text{Ac}$ could be expected on HBr hydrolysis. PhH_2PO_4 (or PhOPOCl_2) + AcCl was tried without success. The amt. of HCl given off during the prepn. according to N. and S. shows that *p*- $\text{AcOC}_6\text{H}_4\text{Ac}$ is not formed. Dry satd. HCl in PhOAc treated gradually with 1 equiv. of AlCl_3 (vigorous reaction at first), refluxed for 2 hrs. until no more HCl comes off, the yellow viscous mass treated with boiling H_2O , and the sepg. oil dissolved in EtOH and repptd. by the addn. of H_2O gives *p*- $\text{HOC}_6\text{H}_4\text{Ac}$ in 28.82% yield. BASIL C. SOYENKOFF

The reality of semipinacolic rearrangement. Study of anisylmethylglycol. JEANNE LEVY and P. WEILL. *Compt. rend.* 185, 135–7(1927); cf. C. A. 21, 1111.—New evidence is given proving the reality of semipinacolic transformation. Anisylmethylglycol is transformed by semipinacolic dehydration and migration of the Et radical into 3-anisyl-2-pentanone, while 2-anisyl-2-methylbutanal by the action of concd. H_2SO_4 gives 2-anisyl-3-pentanone. The oxide of 1-anisyl-2-methyl-1-butene by distn. at about 250° isomerizes into 3-anisyl-2-pentanone. In the semipinacolic transposition the ethyl group migrates more easily than the methyl group. F. C. H.

The principle of induced alternating polarity in organic compounds and the general and *o*-effect of substituents. C. F. VAN DUIN. *Rec. trav. chim.* 46, 256–67(1927).—I. According to Verkade (C. A. 20, 2937), a general and alternating effect, starting from the same key atom, are not in agreement with one another, as this would mean that this atom can induce electron displacements in opposite directions. It is shown that this opinion is not correct; according to Kermack and Robinson (C. A. 16, 2633) and to Højendahl (C. A. 18, 2836) the alternating effect is transmitted by means of the C chain and the terms positive and negative can be legitimately applied in this sense only, that a negative atom has the electrons longer and a positive shorter in its neighborhood than would be the case in absence of the key atom. On the other hand it is generally assumed (Lewis) that the general effect causes definite electron displacements, while recent researches make highly probable that this effect is not transmitted by means of the C chain; otherwise it would be incomprehensible how it could be detected so far from the key atom as has been shown to be the case in the hydration of stearolic

acid (Robinson and Robinson, *C. A.* 20, 3445). II. The question whether or not the alternating effect is transmitted through the C chain has also been discussed by Olivier and Berger (*C. A.* 21, 2887) in connection with the reaction of Friedel and Crafts between the nitrobenzyl chlorides and benzene. They consider the action of the catalyst to be a direct one and much stronger than the alternating effect, the latter being only feebly perceptible in the hydrolysis of the nitrobenzyl chlorides. van D. does not agree with these views; in his opinion a strong alternating effect is to be expected in the reaction of Friedel and Crafts because of the red color which develops when the reacting components are brought together. Thus he comes to a conclusion, different from that of O. and B., viz., that the expts. on the reaction of Friedel and Crafts do not give a more or less negative indication, but a strongly positive proof for the correctness of the principle of induced alternating polarity. III. A method is presented for the calcn. of the general, alternating and *o* effect of substituents, which is based on the above mentioned theory of Højendahl and on the supposition that the general and alternating effect decrease in strength in the same way with increasing distance from the key atom. From the figures obtained by Olivier in the hydrolysis of substituted benzyl chlorides (*C. A.* 18, 48) the 3 effects were calcd. for the Me, Cl, Br, I, CO₂H and NO₂ groups and, although for details of the calcn. as well as of the results the original paper must be consulted, emphasis must be laid on the fact that for the Me group a strong retarding and for the NO₂ group a relatively strong accelerating *o*-effect was found. IV. In connection with this result mention is made of several reactions, in which the SO₃H and the OMe groups exhibit accelerating as well as retarding *o*-effects, an acceleration occurring in the esterification of the sulfobenzoic acids with MeOH, in the hydrolysis of the sulfaminobenzoic acids with mineral acids and in the action of sodamide on methoxybenzophenones. A retarding *o*-effect is noticed in the sapon. of the Me esters of the sulfobenzoic acids and, quite unexpectedly, in the sapon. of the *Et o* methoxy-trans-cinnamate, m. 34-4.5°, prepd. from pure acid (in 184-4.5°) by the Fischer procedure.

C. F. VAN DUIN

Electron displacement and alternating polarity; their quantitative relation in aromatic compounds. G. BERGER *Rec trav chim.* 46, 511-8 (1927).—van Duin (preceding abstract) doubted whether the general effect of a substituent is transmitted by means of the C chain on the ground that the general effect is still perceptible at a far greater distance from the key atom than would be possible according to the theory of Højendahl (*C. A.* 18, 2836). The quant. relations of H.'s theory cannot be right, this theory requiring that the introduction of a β Cl atom into crotonic acid would enhance the dissoen. const. three times as much as the introduction of a β Cl atom into PrCO₂H, while the ratio: dissoen. const. β -chlorocrotonic acid/dissoen. const. crotonic acid = 6.55 and the ratio: dissoen. const. β -chlorobutyric acid/dissoen. const. butyric acid = 6.04. Also the introduction of a *m*-Me group into BzOH would diminish the dissoen. const. 3.3 times as much as the introduction of such a group into hexahydrobenzoic acid; however, the ratio: dissoen. const. *m*-toluic acid/dissoen. const. BzOH = 0.85 and the ratio: dissoen. const. hexahydro *m*-toluic acid/dissoen. const. hexahydrobenzoic acid = 0.96. A method is presented to calc. the *o*, alternate and general effect of substituents, the assumption being made that the total influence of these effects is the product of the sep. influences of each substituent and not the sum as had been assumed by van Duin. This assumption was made, the expts. of Olivier (*C. A.* 20, 2485) on the hydrolysis of substituted benzyl chlorides and of Goldsworthy (*C. A.* 20, 2840) on the reaction between substituted phenolates and EtI having proved that the influence of 2 substituents is the product of the influences of each substituent separately in the same position. In the case of the hydrolysis of the substituted benzyl chlorides the following equations are obtained: For the halogens $K_0 = K.a_0.\omega/g_0$; $K_m = K/a_m.g_m$; $K_p = K/a_p.g_p$; for the COOH and NO₂ groups $K_0 = K.\omega/a_0.g_0$; $K_m = K.a_m/g_m$; $K_p = K/a_p.g_p$; for the Me group $K_0 = K.a_0.g_0.\omega$; $K_m = K.a_m/g_m$; $K_p = K.a_p.g_p$; K_0, K_m, K_p being the reaction consts. of the unsubstituted and the isomeric substituted benzyl chlorides, resp., and *a*, *g* and ω the alternate, general and *o*-effect. Secondly the assumption is made that the alternate and general effect decrease in the same way with increasing distance from the key atom, which gives the equations: $a_0/g_0 = a_m/g_m = a_p/g_p$. By means of these equations it is possible to calc. for the halogens *a*, *g*, ω and for the other substituents *a*_p and *g*_p. The calculation has been carried out for the hydrolysis of the substituted benzyl chlorides (Olivier, *C. A.* 18, 48), for the reaction between ethylene oxide and phenolates (Boyd and Marie, *C. A.* 9, 198) and for the sapon. of substituted Et benzoates (McCombie and Scarborough, *C. A.* 9, 1466).

C. F. VAN DUIN

Earliest history of the Friedel-Crafts reaction. A. A. ASHDOWN. *Ind. Eng.*

Chem. 19, 1063-5(1927).—In honor of the 50th anniversary of the discovery of the Friedel-Crafts reaction A. has given a translation of the original article as it was presented before L'Académie des Sciences. A brief history of the life of James Mason Crafts, who later became president of M. I. T., also is given. D. H. POWERS

Chlorobenzene and its most important derivatives. I. ZUCKERMANN. *J. Chem. Ind. (Russia)* 2, 338-42; *Chem. Zentr.* 1926, I, 3317.—An exhaustive study was made of the nitration of *PhCl* according to the method of Schaarschmidt (*C. A.* 19, 1252); of the sepn. of *o*- and *p*-*ClC₆H₄NO₂*; of the conversion of *o*-*ClC₆H₄NO₂* to *o*-nitroanisole by the action of alc. NaOH (cf. Blom, *C. A.* 15, 3996) in which it was found that increasing the concn. under 3-5 atm. pressure accelerates the reaction, but that the yield of the by-product, *o*-chloroazoxybenzene also increases, that the formation of azoxy compds. becomes temporarily the chief reaction, and that the most suitable method is to work at first without excess pressure and only to increase the pressure when the alky. of the soln. has diminished to about 50% of its value; and of the reduction of *o*-nitroanisole to *o*-anisidine and hydrazoanisole. C. C. DAVIS

Coordination compounds of beryllium and *m*- and *p*-nitrobenzoylacetone. HENRY BURGESS. *J. Chem. Soc.* 1927, 2017-9.—*p*-Nitrobenzoylacetone, golden yellow, m. 112-3.5°, in 1.5 g. yield from 50 g. *p*-O₂NC₆H₄CO₂Et, 19.8 g. Me₂CO and 10.5 g. NaNH₂ in 150 cc. Et₂O at -17°. *Be* compd., brownish yellow, m. 243-4°. *m*-Nitrobenzoylacetone, pale yellow, m. 114-5°; FeCl₃ gives a wine-red color; *Be* compd., orange-yellow, m. 207-8°. *Et* bis-*p*-nitrobenzoylacetatoacetate, m. 137-9°, and *Et* *p*-nitrobenzoylacetatoacetate, pale yellow, m. 43-5°, result from AcCHNaCO₂Et and *p*-O₂NC₆H₄CH₂Br; the latter gives a deep reddish purple color with FeCl₃ and a green Cu deriv. C. J. WEST

Reactions of displacement in the tropic acid group. II. C. A. KERR. *J. Chem. Soc.* 1927, 1943-8; cf. McKenzie and Strathern, *C. A.* 19, 1134.—Chlorotropic acid (I) is conveniently prepd. in 16 g. yield from 27 g. CH₂:CPhCO₂H in 135 cc. H₂O contg. 2 cc. glacial AcOH and 1.5 mols. H₂NCONHCl soln., 8 g. CH₂:CPhCO₂H being recovered. I could not be reduced to tropic acid. The action of NaOH or Na₂CO₃ on I gives HOCH₂CPh(OH)CO₂H, m. 144-5°. I (3 g.) in 50 cc. concd. NH₄OH, allowed to stand 7 days at 0°, gives 1.3 g. α -amino- β -hydroxy- α -phenylpropionic acid (II), m. 285-8° (decompn.), $[\alpha]_D^{20}$ 40.6° (HCl, *c* 6.208); *HCl* salt, prisms, m. 225° (decompn.). I may be resolved by morphine in MeOH, 30 g. I finally giving 5.8 g. *d*-I, $[\alpha]_D^{15}$ 12.6° (MeOH, *c* 3.025), m. 123-4°; the mother liquor gives the *l*-I, $[\alpha]_D^{15}$ -12.4° (MeOH, *c* 3.586). The action of Na₂CO₃ on *d*-I gives inactive HOCH₂CPh(OH)CO₂H, as does Ag₂O; concd. NH₄OH gives II, with the same rotation. C. J. WEST

Constitution of the chlorides of acetylated α -hydroxy acids. E. E. BLAISE AND HERZOG. *Compt. rend.* 184, 1332-3(1927); cf. *C. A.* 6, 1287.—From the Ac derivs. of α -HO acids and SOCl₂ are obtained chlorides which would be expected to have the formula: RCH(OAc)COCl (I). These chlorides react with org.^o Zn derivs. as though they had the formula: R'CH.CO.O.CR''Cl.O (II), and react in the presence of Al₂Cl₆

as II and as I, formed from II by isomerization. There is no indication that I and II are tautomers. The chloride (III) of Me₂C(OAc)CO₂H, b₁₇ 70° (anilide, m. 100°) and C₆H₅ in the presence of Al₂Cl₆ give Me₂C(OAc)COPh (IV) and Me₂C.CO.O.CMePh.O

(V). IV, b₁₄ 135-7°; semicarbazone, m. 186-8°; *p*-nitrophenylhydrazone, m. 171°. Me₂C(OH)COPh, derived from IV by hydrolysis, b₁₉ 125°; semicarbazone, m. 184-5°; oxime, m. 106°. V, m. 60°, gives on hydrolysis Me₂C(OH)CO₂H and MeCOPh. III and *p*-C₆H₄Me₂ in the presence of Al₂Cl₆ give *p*-Me₂C(OAc)CO.C₆H₄Me₂ (VI), *p*-Me₂C(OH)CO.C₆H₄Me₂ (VII) and 2,5-Me₂C₆H₃COMe (VIII), VII and VIII being decompn. products of a cycloacetal homologous to V. VI, b₁₇ 148°; *p*-nitrophenylhydrazone, m. 212°. VII, b₁₆ 130°; semicarbazone, m. 166°. *p*-Nitrophenylhydrazone, m. 219°. VIII gives a semicarbazone, m. 153°, and a *p*-nitrophenylhydrazone, m. 152°.

MARGARET W. MCPHERSON

Intermolecular condensation of styryl methyl ketones. I. ROBT. DICKINSON, I. M. HEILBRON AND FRANCIS IRVING. *J. Chem. Soc.* 1927, 1888-97.—3,4-(MeO)₂-C₆H₃CH:CHAc (I) m. 85-6°; semicarbazone, m. 205°; it is phototropic, becoming S-yellow on short exposure to light; from 50% AcOH it seps. as canary-yellow needles, m. about 180°, probably an unstable acetate. 3,4-(MeO)₂-C₆H₃CHO and I in EtOH or with Me₂CO give 3,3',4,4'-tetramethoxydistyryl ketone (II), m. 84° (tetra-bromide, m. 152°). II and AcCH₂CO₂Et with EtONa in EtOH give *Et* 3-*m*,*p*-dimethoxyphenyl-5-*m*,*p*-dimethoxystyryl- Δ^4 -cyclohexen-1-one-2-carboxylate, bright yellow, m. 160-1°, which, boiled with AcOH-H₂SO₄ for 4 hrs., gives 3-*m*,*p*-dimethoxyphenyl-5-*m*,*p*-dimeth-

oxystyryl- Δ^4 -cyclohexen-1-one, m. 168°, identical with the compd. obtained by Francesconi and Cusmano (C. A. 2, 2951) from 3,4-(MeO)₂C₆H₃CHO and aq. Me₂CO with NaOH; the monosemicarbazone, golden yellow, m. 226-7°. I (20 g.), heated on the steam bath with 30 cc. piperidine for 24 hrs. gives a dimeride of I, amorphous powder, m. 209-10°. 3-Methoxy-4-ethoxystyryl Me ketone, from ethylvanillin and Me₂CO with 1% NaOH, yellow needles, m. 106°, from dil EtOH; or colorless after standing in H₂O or C₆H₆Me₂ suspension for several weeks in direct sunlight; semicarbazone, pale yellow, m. 208-9°; dimeride, amorphous, m. 187°; if 10% NaOH soln. is used, there results 3,3'-dimethoxy-4,4'-diethoxystyryl ketone, yellow, m. 123-4°. Propylvanillin, m. 59-60° (60% yield); semicarbazone, m. 156°. 3-Methoxy-4-propoxystyryl Me ketone, bright yellow, m. 92-3°; with Me₂CO and 2 N NaOH, this gives a small amt. of 3-m-methoxy-p-propoxyphenyl-5-m-methoxy-p-propoxystyryl- Δ^4 -cyclohexen-1-one, pale yellow, m. 152-3°; it absorbs 2 mols. Br but a solid tetrabromide could not be isolated. Isopropylvanillin, b₁₈ 150-2°; semicarbazone, m. 151-2°. 3-Methoxy-4-isopropoxystyryl Me ketone, yellow, m. 51-3°; semicarbazone, yellow, m. 203-4°. 3-Methoxy-4-benzoyloxystyryl Me ketone, yellow, m. 93°; semicarbazone, yellow, m. 200-1°; 3,3'-dimethoxy-4,4'-dibenzoyloxystyryl ketone, golden yellow, m. 155°; tetrabromide, m. 141° (decompn.); an apparent isomer was obtained when 10 g. of the monostyryl ketone in 36 cc. Me₂CO and 36 cc. EtOH were treated with 25 cc. 8% NaOH: it forms dark orange-yellow needles, m. 174-5°; a solid bromide could not be isolated. Phenyl 3,4-dimethoxystyryl ketone, yellow, m. 88°; this could not be condensed to a cyclohexenone. C. J. WEST.

Grignard synthesis of certain organic arsenic derivatives. E. GRYSZKIEWICZ-TROCHIMOWSKI AND E. ZAMBRZYCKI. Roczn. Chem. 6, 794-803 (1926).—As₂O₃ added to Et₂O solns. of various Mg org. derivs yields with Mg aryl salts partly oxidized products, while alkyl salts produce trialkylarsines. Thus the following compds. are prepd.: diphenylarsine oxide, dibenzylarsenious acid, di- α -naphthylarsine oxide, trimethylarsine, b. 48-51°, triethylarsine (when chlorodimethylarsine, b. 155°, is prepared), tri-n-propylarsine and triallylarsine, b₁₇ 104°. B. C. A.

Synthesis of some new acylated derivatives of arsanilic acid. II. T. UKAI, T. HASEGAWA AND M. HASHIMOTO. J. Pharm. Soc. Japan No. 536, 871-4 (1926).—In paper I (Ibid No. 534, 662), acetylsalicylarsanilic acid (I) could not be obtained from atoxyl by heating with aspirin, because of decompn. of the latter. By converting aspirin first to o-AcOCCl₂COCl with PCl₅, and then heating with aq. atoxyl in the presence of NaHCO₃, I was obtained. Contrary to published data, I is slightly sol. in Et₂O. Next p-MeC₆H₄COCl was similarly heated with atoxyl, and p-tolylarsanilic acid was obtained. S. T.

Wislicenus' method for the preparation of ketonic acids. N. KISHI AND Z. KISHI. J. Pharm. Soc. Japan No. 545, 574-7 (1927).—One mol. of 4-nitro-m-xylene and 1 mol. of (CO₂Et)₂ in Et₂O in presence of KOEt give 2-nitro-5-methylphenylpyroracemic acid, the only mono-condensation product (63% yield), showing that the Me group ortho to the NO₂ group is the only reactive group of the 2 Me groups. NAO UYEI.

Camphor oils. VIII. Catalytic action of Japanese acid clay upon cineole. KASHICHI ONO AND SHUJI MIYAZAKI. Bull. Chem. Soc. Japan 2, 207-9 (1927); cf. C. A. 21, 1642.—Cineole (500 g.) heated with 150 g. Japanese acid clay at 180° 2 hrs. reacted violently, losing H₂O and forming 102 g. of hydrocarbon oils consisting of dipentene, p-cymene and dipinene. A. W. FRANCIS.

The terpene series. A. DUBOSC. Peintures, pigments, vernis 4, 336-8, 356-8, 380-2 (1927).—Brief review of work done on the constitution of terpenes during the last 100 yrs. A. PAPINEAU-COUTURE.

New terpene alcohol, C₁₅H₁₈O. O. ACHMATOWICZ. Roczn. Chem. 6, 804-14 (1926).—Bornyl acetate, prepd. in presence of H₂SO₄ or ZnCl₂, yields on hydrolysis a new alc., apparently a space isomeride of borneol, termed endoborneol, m. 186°, b. 203-204°, which on oxidation yields camphor. Its Et ether, b₂₀ 83-87°, b_{7M} 197-198°, phenylurethan, m. 138-139°, and benzoate, b₁₈ 186-187°, are described. B. C. A.

Factors influencing the production of terpineol from α -pinene in acid solution. F. G. GERMUTH. Am. J. Pharm. 99, 402-5 (1927).—Differences in temp. affect very markedly the % yield of terpineol from PhSO₃H and α -pinene in AcOH soln. Addition of H₂O, also, has a tendency to retard the production of this compd., more particularly at lower temps. When the amt. of H₂O added is increased from 1.0 to 5.5%, with increase in temp. of the soln., the effect upon the production of the substance sought is not proportional to the amt. of H₂O added; apparently, the differences existing in temp. compensate for the decided increase in the H₂O content. A temp. of about 95°, with a soln. containing the least possible amt. of H₂O, evidently insures the highest yield

of terpineol from PhSO_3H and α -pinene in AcOH soln., when mol. quantities are employed.

W. G. GAESSLER

δ -*d*-Bornylsemicarbazide and δ -*d*-neobornylsemicarbazide. J. A. GOODSON. *J. Chem. Soc.* 1927, 1997–2000.—*d*-Bornylamine and $\text{Me}_3\text{C}:\text{NNHCONH}_2$ at 75° give 76% of acetone- δ -*d*-bornylsemicarbazone, m. $141\text{--}8^\circ$ (all m. p. cor.), $[\alpha]_D^{20}$ 25.5° (EtOH, c 2.04); heating with 10% HCl on the H_2O bath for 1.5 hrs. gives 94% of the HCl salt, m. $190\text{--}8^\circ$, crystg. with $2\text{H}_2\text{O}$, $[\alpha]_D^{20}$ 2.6° (EtOH, c 5), of δ -*d*-bornylsemicarbazide, m. 75° , $[\alpha]_D^{20}$ 17° (EtOH, c 5); semicarbazones were prepd. of isopulegone, m. $224\text{--}6^\circ$, $[\alpha]_D^{18}$ 9.2° (CHCl_3 , c 5.04); 4-methylcyclohexanone, m. 145° , $[\alpha]_D^{20}$ 27.2° (EtOH, c 4.898); 3-methylcyclohexanone, m. $172\text{--}7^\circ$, $[\alpha]_D^{20}$ 27.4° (EtOH, c 4.85); recrystn. failed to resolve it into its components, even when seeded with the *d*-deriv., m. $173\text{--}9^\circ$, $[\alpha]_D^{20}$ 7.4° (EtOH, c 4.726). Acetone- δ -*d*-neobornylsemicarbazone, m. $175\text{--}9^\circ$, $[\alpha]_D^{20}$ -92.1° (EtOH, c 2.008); hydrolysis gives δ -*d*-neobornylsemicarbazide HCl, m. $198\text{--}202^\circ$, $[\alpha]_D^{20}$ -50.8° (EtOH, c 4.982), crystg. with $1\text{H}_2\text{O}$; the following semicarbazones were prepd.: 4-methylcyclohexanone, m. $151\text{--}5^\circ$, $[\alpha]_D^{20}$ -91.3° (EtOH, c 2.83); 3-methylcyclohexanone, m. $157\text{--}61^\circ$, $[\alpha]_D^{20}$ -91.2° (EtOH, c 4.772).

C. J. WEST

Camphor group. VI. New method of preparing epicamphor. Y. MURAYAMA AND S. TANAKA. *J. Pharm. Soc. Japan* No. 545, 549–51 (1927); cf. *C. A.* 20, 595, 2674.—The shortest method of prepg. epicamphor (I) is to reduce *p*-chloroepicamphor semicarbazone with EtOH and Na. The resulting epicamphor is heated with HCl to obtain I.

NAO UYEI

Chlorocamphoranilic acids and camphorochlorophenylimides. MAHAN SINGH AND RAM SINGH. *J. Chem. Soc.* 1927, 1994–7; cf. Wootton, *C. A.* 4, 2107.—Condensation of camphoric anhydride with *o*-, *m*- and *p*- $\text{ClC}_6\text{H}_4\text{NH}_2$ yields a mixt. of chlorocamphoranilic acid and camphorimide derivs.; W.'s in. ps. are low, because the acids contained the imides formed in the condensations. 2'-Chlorocamphoranilic acid, m. 165° ; 3'-Cl deriv., m. $216\text{--}7^\circ$; 4'-Cl deriv., m. 197° . The rotations of the acids and imides in MeOH, EtOH, Me_2CO and MeEtCO are given; there was no mutarotation.

C. J. WEST

Coumarin series. I. Action of the Grignard reagent upon substituted coumarins. I. M. HELLBRON AND D. WM. HILL. *J. Chem. Soc.* 1927, 2005–13.— PhMgBr and 4-hydroxycoumarin in $\text{Et}_2\text{O}-\text{C}_6\text{H}_6$ give 4-hydroxy-2,2-diphenyl- Δ^2 -chromene, m. $230\text{--}1^\circ$, sol readily in NaOH and Na_2CO_3 . 4-Methoxycoumarin gives the 4-MeO deriv., m. 135° ; hydrolysis gives $\text{Ph}_2\text{C}:\text{NOH}$. 4-Methoxy-2,2-dianisyl- Δ^2 -chromene, m. 155° . 1-Methylcoumarin and PhMgBr give 2,2-diphenyl-4-methyl- Δ^2 -chromene, m. 89° ; hydrolysis gives benzohydryl Ph ether, m. 56° . 2,2-Diphenyl-4,6-dimethyl- Δ^2 -chromene, m. 126° . Hydrolysis gives benzohydryl *p*-tolyl ether, m. 96° . 4,7-Dimethylcoumarin and PhMgBr give 10% of diphenyl-2-hydroxy- β ,4-dimethylstyrylcarbinol, m. 146° ; from the mother liquor are isolated 75% of 2,2-diphenyl-4,7-dimethyl- Δ^2 -chromene, m. 87° , also obtained by heating the carbinol in AcOH for 1 hr.; hydrolysis gives benzohydryl *m*-tolyl ether, m. 125° . 3-Methylcoumarin and PhMgBr give 2,4-diphenyl-3-methylchroman-2-ol, m. 149° ; boiling this with AcOH 1 hr. gives 2,4-diphenyl-3-methyl- Δ^2 -chromene, m. 91° . The primary reactions with the Grignard reagent follow a common course, the ultimate formation of a Δ^2 - or Δ^3 -chromene being influenced solely by the substituent in the pyran ring. Two possible explanations of this postulation are given.

C. J. WEST

Synthesis in the imidazole series: some derivatives of isoimidazole. P. C. MITTER AND N. N. SINHA. *Quart. J. Indian Chem. Soc.* 3, 401–4 (1926).—Aq. KOH added to aq. $\text{PhC}:(\text{NH})\text{NH}_2\cdot\text{HCl}$ followed by addn. of $(\text{CO}_2\text{Et})_2$ with occasional shaking for 3–4 days gives 2-phenyl-4,5-diketo-4,5-dihydroimidazole (I), m. 174° (decompn.). Extn. of $\text{PhC}:(\text{NH})\text{NH}_2$ from the neutralized salt with ether and treatment with $(\text{CO}_2\text{Et})_2$ drop by drop gives I. 2-Phenyl-4-chloro-5-ketoisoimidazole, prepd. by heating I with POCl_3 , pouring on ice, nearly neutralizing with Na_2CO_3 , evapg. to dryness and extg. with abs. alc., m. 215° (decompn.). 2-*p*-Tolyl-4,5-diketodihydroimidazole (II), prepd. from *p*- $\text{MeC}_6\text{H}_4\text{C}:(\text{NH})\text{NH}_2\cdot\text{HCl}$ by methods analogous to those for I, has no m. p. to 280° . Addn. of $\text{H}_2\text{NOCCO}_2\text{Et}$ to *p*- $\text{MeC}_6\text{H}_4\text{C}:(\text{NH})\text{NH}_2$ in Et_2O liberates NH_3 and after standing for a day gives II. POCl_3 and II were heated 15 min. and poured on ice, giving a cryst. HCl salt, which, filtered, dissolved in a small vol. of H_2O and poured into concd. AcONa , gives 2-*p*-tolyl-4-chloro-5-ketoisoimidazole, sublimes $260\text{--}5^\circ$. The ketochloro compds. represent the previously unknown isoimidazoles. Acetamidine did not yield analogous compds.

FOSTER D. SNELL

Pseudourethans. I. HEMENDRA KUMAR SEN AND CHITTARANJAN BARAT. *Quart. J. Indian Chem. Soc.* **3**, 405-14 (1926).—Negative results with chloralacetophenone, $\text{CCl}_3\text{CH}(\text{OH})\text{CH}_2\text{COPh}$ (I), indicate the importance of configuration in the theories of Sen (*Proc. 12th Indian Science Congress* 1925, 113) and of Graaff and Le Fevre (*C. A.* **20**, 218) which assume an intermediate oxide in alc. fermentation. Mixing I and excess ClCONH_2 in Et_2O , distn. of the Et_2O after 15 min. and decompn. of the excess ClCONH_2 with ice water gives a solid (II) having the compn. $\text{C}_{11}\text{H}_{17}\text{Cl}_2\text{NO}_2$. Dissolved in warm MeOH or EtOH and dild. with water II is pptd. as small prisms, m. 155° (decompn.). Boiled with abs. alc. 2 hrs., II is converted to $\text{CCl}_3\text{CH}:\text{CHCOPh}$. II, BzH and HCl do not give benzylidenediurethan. II probably is a *pseudourethan*, $\text{CCl}_3\text{CH}:\text{CH}_2$, $\text{CPh}(\text{OH})\text{NHC}(\text{O})\text{O}$, *i. e.*, a metoxazine. Condensation of 8 g. of CCl_3CHO

with 7 g. of $p\text{-MeC}_6\text{H}_4\text{COMe}$ in AcOH gives on recrystn from petroleum ether 4 g. of chloralacetolone, m. 100° . The *pseudourethan*, m. 160° , refluxed 3 hrs. in abs. alc. gives $\text{CCl}_3\text{CH}:\text{CHCOC}_6\text{H}_4\text{Me}$. α -Acetonaphthone and chloral refluxed in AcOH for 18 hrs. give a dark oil. This was washed with hot H_2O , dissolved in Et_2O , dried with Na_2SO_4 and filtered. Evapn. of the Et_2O and extn. of the oily residue with petroleum ether several times, decanting from the solid, gave chloralacetomaphthone, m. $90-2^\circ$. The *pseudourethan*, m. 125° , refluxed with abs. alc. for 2 hrs. gives tri-chloroethylidenacetomaphthone, m. $104-6^\circ$. The *pseudourethan* of chloralacetone, prepd. with poor yield, m. 98° (decompn.). α -Acetoveratrone condensed with chloral to give chloralacetoveratrone, m. $120-2^\circ$. The *pseudourethan* was not purified satisfactorily. Hydracetylacetone and ClCONH_2 gave ethylidenacetone. Similarly diacetone gave mesityl oxide. It appears that the CCl_3CHO group imparts stability to the aldol phase. In confirmation an attempt to prep. benzaldehydeacetophenone with AcOH as condensing agent gave benzylidenacetophenone.

FOSTER D. SNELL.

Derivatives of 1,3-diphenylhydrindene. RICHARD WEISS AND SAMI LUFT. *Monatsh.* **48**, 337-45 (1927).—Diphenylindene (2 g.) and 1.2 g. Br in Et_2O give 85-90% of the 2,3-dibromo deriv., m. $92-6^\circ$; with boiling MeOH this gives 1,3-diphenyl-2-bromo-1-methoxyhydrindene, m. $150-1^\circ$. Phenylhydrindone and Br in CHCl_3 give nearly quant. 2,3-dibromo-3-phenylhydrindone-1 (I), m. $123-4^\circ$; with MeOH at 150° for 6 hrs. this yields 60% of 2-bromo-3-phenylindone-1, m. $112-3^\circ$; this also results with $\text{C}_6\text{H}_5\text{N}$ or $\text{C}_6\text{H}_7\text{N}$. I and 2.5 mols. PhMgBr give 50% of 2-bromo-3-phenylhydrindone-1, m. $78-80^\circ$, the PhMgBr having only a reducing action. Bromophenylindene and PhMgBr , followed by acetylation, give 2-bromo-1-acetoxy-1,3-diphenylindene, yellow, m. $115-7^\circ$. 2,2-Dimethyl-1,3-diketohydrindene and PhMgBr give 20% of 3-phenyl-3-hydroxy-2,2-dimethylhydrindone-1, m. $139-41^\circ$; HCl gives the 3-chloro deriv., m. $107-8^\circ$, which reacts with MeOH to give the 3-methoxy deriv., m. $160-2^\circ$. The latter with PhMgBr gives 1,3-diphenyl-3-methoxy-1-hydroxy-2,2-dimethylhydrindene, m. $172-4^\circ$. C. J. W.

Isomeric hydroxybenzylidimethylamines. EDGAR STEDMAN. *J. Chem. Soc.* 1927, 1902 6.—The $\text{MeOC}_6\text{H}_4\text{CH}_2\text{Br}$ and excess Me_2NH in C_6H_6 were allowed to stand 24 hrs., the base was extd. with HCl and again liberated with NaOH and distd.; the phenol was then obtained with HBr . *m*-Methoxybenzylidimethylamine, b_{13} 105° ; HCl salt, m. 173° ; *m*-hydroxy deriv., m. 108° ; HCl salt, m. 152° ; *p*-MeO deriv., b_{13} 109° ; HCl salt, m. 152° ; *p*-HO deriv., m. 106° ; HCl salt, m. 185° ; *o*-methoxy deriv., b_{20} 113° ; HCl salt, m. 149° ; *o*-hydroxy deriv., b_{12} $99-100^\circ$; methiodide, m. 169° . *o*-Nitrobenzylidimethylamine- HCl , m. 221° ; *o*-amino deriv., b_{14} 107° , m. $36-7^\circ$; *di*- HCl salt, m. 205° . *p*-Nitrobenzylidimethylamine- HCl , pale yellow, m. 188° ; MeI gives *p*-nitrobenzyltrimethylammonium iodide, yellow, m. 198° ; the oxalate of the base, yellow, m. 155° . *Di*-*p*-nitrobenzylidimethylammonium chloride, m. about 176° . *p*-Aminobenzylidimethylamine *di*- HCl , m. 216° . *m*-Nitrobenzylidimethylamine- HCl , m. 230° ; *m*-amino deriv., b_{13} 129° , m. 46° ; *di*- HCl salt, m. 225° . C. J. WEST

Gold and mercury derivatives of 2-thiolglyoxalines. Mechanism of the oxidation of 2-thiolglyoxalines to glyoxalines. I. E. BALABAN AND HAROLD KING. *J. Chem. Soc.* 1927, 1858-74.—2-Thiol-4(or 5)-methylglyoxaline-5(or 4)-carboxylic acid (V), by hydrolysis of the Et ester (I) with Na_2CO_3 soln., m. $240-1^\circ$ with loss of CO_2 ; the acid gives a red color with Pauly's reagent in Na_2CO_3 soln.; an EtOH soln., satd. with HCl , gives the Et ester of the 2-Et deriv. (II), crystg. with $1.5\text{H}_2\text{O}$, m. $144-5^\circ$; picrate, yellow, m. $135-6^\circ$; II was also obtained from I, EtOH and HCl . Alk. hydrolysis of II gives 2-ethylthiol-4(or 5)-methylglyoxaline (III), m. $69-71^\circ$; picrate, m. $136-7^\circ$; chloroaurate, red, m. $130-1^\circ$. The alk. mother liquor after extn. of III by Et_2O , made acid and concd., gives 2-ethylthiol-4(or 5)-methylglyoxaline-5(or 4)-carboxylic acid semi- HCl (IV), m. $122-5^\circ$ (decompn.); the free acid (V), m. $179-80^\circ$ (decompn.) giving III; it is sol. in 10 parts boiling H_2O . III in hot 3 *N* HCl deposits the HCl salt, crystg. with $1\text{H}_2\text{O}$, m. $189-90^\circ$

(decompn.). Oxidation of I with 0.1 N I soln. gives 86% of 5(or 4)-carbethoxy-4(or 5)-methyl-2-glyoxaline disulfide, pale yellow, m. 222-3°; this is also obtained by alk. oxidation with $K_3Fe(CN)_6$ or with N oxides. Hydrolysis with Na_2CO_3 gives a mixt. of I and 2-thiol-4(or 5)-methylglyoxaline. I and 2-thiol-4(or 5)-methylglyoxaline gives VI. I (1.86 g.) in 100 cc. MeOH and 1 g. $AuCl_3$ in 30 cc. MeOH give the 2-*auro deriv.*, m. 252° (decompn.); attempts to prep. the free acid led to decompn. with the sepn. of Au, but the 2-*auro deriv.* of V was prepd. in 77% yield from V and $AuCl_3$ in MeOH, pale primrose-yellow powder, gives a pale yellow soln. in $NaHCO_3$, which can be boiled without decompn. Et glyoxaline-4(or 5)-carboxylate and $Hg(OAc)_2$ in EtOH give the 1-*acetoxymercuri deriv.*, shrinks at 222° and is not further changed at 300°; it crysts. with 1.5 H_2O ; NaOH gives orange-yellow HgO . I gives the 2-chloromercuri *deriv.*, m. 167-8°, sol. in 3 vols. boiling abs. EtOH. V also gives a 2-chloromercuri *deriv.*, m. 257° (decompn.), sol. in $NaHCO_3$ and pptd. unchanged by HCl. VI and H_2O_2 at 0 to -5° gives the unstable 4(or 5)-methylglyoxaline-2-sulfonic acid, changing in a few hrs. to a clear liquid, from which seps. the normal sulfite of 4-methylglyoxaline. If, after the sulfonic acid has crystd. out, 2 N NaOH is added till the soln. is alk., the soln. coned. at room temp. over H_2SO_4 *in vacuo* and then made acid, the 2-sulfonic acid, crystg. with 1 H_2O and m. about 280°, is obtained; Ca and Ba salts are very sol. in H_2O ; the NH_4 salt crysts. well. The action of SO_2 on 2-thiolglyoxalines is discussed, as well as quant. absorption expts. Various color reactions for thiolglyoxalines (SO_2 , $AuCl_3$, Sato's reaction for $SC(NH_2)_2$, Tschugaev's reaction, etc.) are also described. Tests of the action of the Au and Hg compds. on tubercle bacilli and toxicities for mice are briefly reported.

C. J. WEST

Cholesterol. III. E. MONTIGNIE. *Bull. soc. chim.* 41, 947-9(1927); cf. C. A. 21, 2477.—The I no. of cholesterol (I) varies according to time from 64.7 in 2.5 hrs. to 82.55 in 50 hrs. Complex I derivs. are formed. I with H_3PO_4 or $CuSO_4$ gives α -cholesterylene, $C_{27}H_{44}$ (II), which with alc.- H_2SO_4 regenerates I. I with P_2O_5 at 150-60° gives a mixt. of II, m. 78-80°, and another unsatd. hydrocarbon, $C_{26}H_{42}$, m. 66-7°, which forms a Br addn. compd., m. 61.2°. I boiled with $Ag_2Cr_2O_7$ and dil. H_2SO_4 is oxidized to oxycholestenone, $C_{27}H_{46}O_2$, m. 125°, which absorbs Br and whose semicarbazide m. 131°.

A. W. FRANCIS

The sterol of colt's foot (*Tussilago farfara*). LEOPOLD SCHMID. *Monatsh.* 48, 289-91(1927), cf. Zellner, C. A. 18, 3449.—The sterol of *Tussilago farfara*, m. 134°, is probably a mixt.; by use of the bromoacetate, an Et_2O -insol. fraction is obtained which appears to be identical with sitosterol.

C. J. WEST

Action of aminobenzyl alcohol on resorcinol. G. B. KAGAN. *J. Chem. Ind. (Russia)* 1927, 230.—If $p\text{-H}_2N\text{C}_6\text{H}_4\text{CH}_2\text{OH}$ is heated with an excess of $o\text{-C}_6\text{H}_3(\text{OH})_2$ in alk. soln., the soln. acidified with H_2SO_4 and boiled a short time, a cryst. substance, 4,2',4'- $\text{H}_2\text{NC}_6\text{H}_4\text{CH}_2\text{C}_6\text{H}_3(\text{OH})_2$, m. 212-5°, seps., which can be recrystd. from a small amount of hot H_2O in needles. It is sol. in EtOH, but with an excess of NaOH ppts. again. If the substance is filtered, the H_2SO_4 of the filtrate is neutralized with an excess of $NaC_2H_3O_2$, another cryst. NH_2 deriv. 1,3,4,6-(HO) $_2\text{C}_6\text{H}_3(\text{CH}_2\text{C}_6\text{H}_4\text{NH}_2)_2$, m. 162-3°, is obtained.

BERNARD NELSON

β -Chloroglutaconic anhydride. R. MALACHOWSKI AND T. KALINSKI. *Rocz. Chem.* 6, 768-73(1926); cf. C. A. 21, 1798.— β -Chloroglutaconic anhydride, m. 113-114°, is obtained from the corresponding acid. From it are prepd., by condensation with PhCH:CHCHO 4-chloro-6-hydroxy-5-cinnamylidene- α -pyrone, m. 171-172°, with PhN_2OH 4-chloro-6-hydroxy- α -pyrone-5-phenylhydrazone, m. 204°, and by bromination 3-chloro-bromo-6-hydroxy- α -pyrone, m. 107.5°, which on hydrolysis yields β -chloro- α -bromoglutaconic acid, m. 131-132°.

B. C. A.

Synthesis of 4-hydroxy-3-methoxystyryl butyl ketone. HIROSHI NOMURA AND SHUNJI TSURUMI. *Science Repts. Tôhoku Imp. Univ.* 16, 563-4(1927).—Vanillin (15.2 g) (I) is heated with 10 g. BuCOMe (II) in 150 g. 95% alc. with 30 g. 1:1 KOH for 6 hrs. under reflux. The product, evapd., extd. with Et_2O to remove II and acidified with concd. HCl yields an oil which is dissolved in Et_2O and freed from I by treatment with bisulfite. The resulting oil, recrystd. from dil. MeOH and dried *in vacuo*, gives 4-hydroxy-3-methoxystyryl butyl ketone (III), m. 39-40°. III by reduction with NaH and H_2O gives 4-hydroxy-3-methoxyphenylethyl butyl ketone.

D. H. POWERS

Unsaturated 1,4-diketones. III. Mode of addition of halogen to dibenzoyl-ethylene. R. E. LUTZ. *J. Am. Chem. Soc.* 49, 1106-11(1927); cf. C. A. 21, 82.—Br adds very nearly quant. at low temps. to *cis*- and *trans*-(BzCH:) $_2$ to give exclusively in the 1st case α - and 2nd case β -(BzCHBr) $_2$. The α -dihalides are obtained exclusively from *dl*-(CHClCO_2H) $_2$ and (CHBrCO_2H) $_2$ by the Friedel-Crafts reaction upon the acid chlorides and the β -halides are obtained from the *meso*-acids. *dl*-Dichlorosuccinyl dichlor-

ide, b_r 78.5°, m. 39°; the dibromo chloride, b_r 85°. The α -dihalides are *dl*- and the β , *meso*-derivs.; the mode of addn. of halogen to the 2 isomers of $(BzCH_2)_2$ is *trans*. α, β -Dichloro- γ, γ -diphenylbutyrolactone, m. 141-2°, is obtained when $AlCl_3$ is added to *meso*-($CHClCOCl$)₂ in C_6H_6 . C. J. WEST

New diketone from phenyl *p*-tolyl ketone. T. W. JEZERSKI. *Rocz. Chem.* 6, 738-40(1926).—The main product of the reaction between p - MeC_6H_4Bz and S is *s-di* p, p' -dibenzoyldiphenylthane ($BzC_6H_4CH_2$)₂, m. 239-240°. B. C. A.

Nitration of β -naphthyltrimethylammonium nitrate. B. H. INGHAM. *J. Chem. Soc.* 1927, 1972-5.— β -Naphthyltrimethylammonium iodide, m. 193° (decompn.); *nitrate*, m. 190° (decompn.); *picrate*, golden yellow, m. 194-5° (decompn.). Nitration of the nitrate at room temp. (3 times its wt. of 99% HNO_3) for 2 hrs. gives almost quant. the 5-nitro deriv., orange yellow, m. 231° (decompn.); *iodide*, golden yellow, m. 194° (decompn.); *picrate*, canary-yellow, m. 254° (decompn.). Since the constitution could not be detd. by oxidation the product was synthesized from 5- $O_2NC_{10}H_6NH_2$ and Me_2SO_4 . The *iodide* of the corresponding 8-nitro salt m. 180°; *picrate*, m. 221-3°. C. J. WEST

Naphthalenesulfonic acids. VIII. Hydrolysis of naphthalene-1,5-disulfonic acid. D. F. J. LYNCH AND JOHN T. SCANLAN. *Ind. Eng. Chem.* 19, 1010-12(1927); cf. C. A. 21, 1466.—1,5- $C_{10}H_6(SO_3H)_2 \cdot 4H_2O$ (I) is prepd by heating $C_{10}H_8$ with 30% oleum on a steam bath for 18 hrs. The hydrolysis of I is studied at temps. from 100° to 220° with 1 to 85% H_2SO_4 . Results obtained indicate that the 1,5-isomer is similar in its behavior to the 1,6-isomer and somewhat less stable. When other sulfonic acids are formed from I complete hydrolysis and subsequent resulfonation undoubtedly occur.

Oxidation of β -naphthol. OTTO DISCHENDORFER AND WERNER DANZIGER. *Monatsh.* 48, 315-36(1927); cf. *Ehrlich, Monatsh.* 9, 527; 10, 115.—Oxidation of β - $C_{10}H_7OH$ according to E. gives 4-(2-carboxyphenyl)-5,6-benzocoumarin (I), m. 281-2°, decompn. at about 320°; the yield is about 2.5%; *Et ester*, m. 123-4°; *Me ester*, m. 152-3°; I does not give an oxime, a Bz or Ac deriv. The 3-bromo deriv., yellow, m. 250-2°, decompn. 274°, crystals with 1EtOH; its *Et ester*, yellow, m. 134°. I is reduced by Na-Hg, giving the 3,4-dihydro deriv. (II), m. 221°. decompn. 250-60°; *Et ester*, m. 147-9°. While I dists. without decompn. at 14 mm., at the ordinary pressure it splits off CO_2 , giving 4-phenyl-5,6-benzocoumarin (III), pale yellow, m. 161-2°; 3-bromo deriv., yellow, m. 198°. II likewise splits off CO_2 on distn., giving 4-phenyl-3,4-dihydro-5,6-benzocoumarin, m. 264°. I has been synthesized from phthalylacetic acid and β - $C_{10}H_7OH$ with concd. H_2SO_4 . 1-Benzoyl-2-hydroxynaphthalene, yellow, m. 138°, from β - $C_{10}H_7OH$, $BzCl$ and $AlCl_3$ in CS_2 ; *acetate*, m. 90-1.5°; heating the acetate at 140-60° for 0.5 hr. gives III. The mechanism of the formation of I is discussed. C. J. WEST

Crystallography of phenyl α -naphthyl ketone. T. J. WOYNI. *Rocz. Chem.* 6, 653-60.—The crystallographic and optical constants of crystals of α - $C_{10}H_7Bz$ were detd. by the theodolite method. B. C. A.

Fluorene series. CH. COURTOT AND C. VIGNATI. *Compt. rend.* 184, 1179-81 (1927); cf. C. A. 21, 1810.—2-Chlorofluorene (I), m. 96-7°, is prepd. from diazotized 2-aminofluorene. Direct chlorination of fluorene in $CHCl_3$ at 0-5° gives a mixt. (II), m. 86°, of I and 2,7-dichlorofluorene, difficult to sep. Oxidation of II with $Na_2Cr_2O_7$ in $AcOH$ gives 2-chlorofluorenone (III), orange-yellow needles, m. 123° (phenylhydrazone, m. 145°) (cf. Geffroy, Univ. Nancy, *Thesis*, 1925), together with 2,7-dichlorofluorenone (IV) (Schmidt, Wagner, C. A. 6, 1146). Reduction of III by Zn in NH_3 alc. gives 2-chlorofluorenol, colorless silky needles, m. 142°. In the same way IV gives 2,7-dichlorofluorenol, fine brilliant needles, m. 154-5°. Nitration of II in $AcOH$ at 70-80° gives 2,7-chloronitrofluorene (V), yellow, m. 237°. The dichlorofluorene is not attacked. V is reduced by Zn in alc.- NH_3 to 2,7-aminochlorofluorene (VI), white lamellas, m. 134°. V is oxidized to 2,7-chloronitrofluorenone (VII), yellow needles, m. 230°, slightly sol. in $AcOH$. Reduction of VII by $(NH_4)_2S$ gives 2,7-aminochlorofluorenone, bluish red, m. 203.5°, reduced by Zn to 2,7-aminochlorofluorenol, colorless, m. 198-200°.

Studies in colored hydrocarbons. IV. The preparation of bifluorenes by the dehydrogenation of hydrocarbons of the bifluorenyl type. A. A. VANSHEIDT. *J. Russ Phys.-Chem. Soc.* 58, 249-69(1926).— $C_{18}H_{12}N$ solns. of bifluorenyl and its analogs become colored in presence of EtOK and absorb atm. O probably according to the scheme $Ar_2CH.CHA_{r_2} + 2KOH \rightleftharpoons Ar_2CK.CKA_{r_2} + 2H_2O$; $Ar_2CK.CKA_{r_2} + O_2 \rightarrow Ar_2C:CA_{r_2} + K_2O_2$ (cf. C. A. 8, 1580). Na substitutes in a similar manner when a PhMe soln. of bifluorenyl is refluxed over the metal, forming a dark ppt., which on shaking with air is transformed into sol. bifluorenes and Na_2O_2 ; it also adds on to the

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double bond in *dibinaphthylene* to form a violet ppt., which is oxidized by air to the same hydrocarbon. The autoxidation of bifluorenyls was used in the following preps. To 0.1 g. dibiphenyleneethane in 10 cc. boiling C_6H_6N was added 3–4 drops of 5 N MeOK, the mixt. shaken until bright orange-yellow and while still hot dild. drop by drop with 3 vols. of NH_4OH . *Dibiphenyleneethane*, m. 188°, sepd. on standing. A similar procedure was followed with pure bischrysofluorenyl, NH_4OH being immediately added on the development of a purplish red color; *sym. di- α -naphthodibenzo-bifulvene*, dark red, m. 317–8°, seps., sol. in warm H_2SO_4 (dark violet, purplish on dild. with H_2O), decolorized by oxidizing agents. Graebe's product (m. 180–90° C 94.96%) was probably impure bischrysofluorenyl. *unsym. Di- α -naphthylenediphenyleneethane*, dark red, m. 315° in CO_2 , was obtained similarly, NH_4OH being added to the dark purple soln.; soly. and behavior toward oxidizing agents are like those of the *sym.* compd., except that H_2SO_4 dissolves it only at 90–100°, the soln. being violet-red (violet-blue for the *sym.*); gives off HBr when treated with Br_2 , then forms a colorless addn. compd. H converts it into *unsym.* hydrobifulvene. A dark blue soln. results with chrysofluorenyldi- α -naphthofluorene; NH_4OH causes the sepn. of tri- α -naphthylphenyleneethene, in small dark blue rods, m. 300° (not sharply); the solns in org. solvents are intense blue and show a single absorption band in the red portion of the spectrum; dissolves in H_2SO_4 at 50–60° with a bright green color. The behavior toward oxidizing and reducing agents resembles that of dinaphthobifulvenes. On the addn. of a large amt. of MeOK to a C_6H_6N soln. of dibinaphthyleneethane an ochre-red color develops and an amorphous green powder can be isolated whose properties resemble those of dibinaphthyleneethene. The red color of the soln. turns to green on the neutralization of alkali or on dild. All the hydrobifulvenes mentioned above form brown ppts. when their $C_{11}H_8Me_2$ solns. are boiled with Na, from which the corresponding bifulvenes result on shaking with air. Dibinaphthyleneethene forms a violet-brown product on second heating (probably a disubstituted Na compd.). The action of Ag oxide and salts.— Ag_2O (in concd. NH_4OH) + 3 vols. of pyridine acts on dibinaphthyleneethane in the cold, and on the other hydrobifulvenes upon warming, to form the colored bifulvenes. AcOAg in pyridine reacts almost quant. in the cold: $Ar_2CHCHAr_2 + 2AcOAg \rightarrow Ar_2C:CAr_2 + 2Ag + 2AcOH$, AcOH being bound by C_6H_6N . The following preps. make use of this reaction. A soln. of 0.8 g. bisdinaphthofluorenyl in 30 cc. C_6H_6N + 0.5 g. AcOAg in 10 cc. C_6H_6N was refluxed for 1 hr. (reaction incomplete), 0.5 g. AcOAg more added and the mixt. heated for 0.5 hr. more. It was filtered on cooling, 50 cc. of concd. NH_4OH slowly added with shaking, then 50 cc. H_2O ; *dibi- α -naphthyleneethene* seps. as a black powder; from xylene very dark green with metallic luster; m. 357° in CO_2 . Microscopic examn. forms the only criterion of purity, since m. p. and compn. are close to those of the hydro compd. The bifulvene is sol. in H_2SO_4 at 50° with a violet-brown coloration; its C_6H_6N soln. is colored, brownish red by the addn. of MeOK (if the soln. was hot it assumes a violet tinge on cooling), while the addn. of acids or ammonia restores the green color of the hydrocarbon. It is the most reactive of all the naphthobifulvenes, the solns. being readily discolored on standing or treatment with H_2O_2 ; reducing agents convert it into dibinaphthyleneethane. Br_2 does not enter the double bond, but displaces the H of aromatic nuclei. Magidson (C. A. 19, 1859) did not obtain the pure product, judging by his analytical, etc., data. *unsym. Di- α -naphthylenediphenyleneethene* prepd. from fluorenyl- α -naphthofluorene and 3 mols. of AcOAg was identical with the autoxidation product (see above). *Tri-naphthobifulvene* from chrysofluorenyldi- α -naphthofluorene and AcOAg was less pure than the same substance obtained by autoxidation. *Bischrysofluorenyl* reduces AcOAg, but does not form the corresponding bifulvene. The method failed also for dibiphenyleneethane. V. The properties of bifulvenes and their hydro derivatives. *Ibid* 269–88.—Hydrobifulvenes possess an affinity toward alkalis and oxidizing agents while bifulvenes are reduced easily and behave like quinones toward H_2SO_4 . Br has dehydrogenating action on bifluorenyl and its naphtho derivs.; with bifulvenes, it enters the nucleus. The color of bifulvenes in C_6H_6 soln. deepens with additional naphtho groups and as we pass from *sym.* to *unsym.* compds. Bifulvenes, unlike ordinary hydrocarbons, are hardly sol. in benzene, EtOH or Et $_2O$; they crystallize with difficulty and tend to retain impurities. Their affinity toward unsatd. solvents (C_6H_6 , C_6H_5N) is detd. by the partial valences. M. p. in general increases with mol. complexity and is higher for bifulvenes than their hydro derivs. Bifulvenes are reduced on boiling with Na and AmOH or with Zn dust and fatty acids, but C_6H_6N affords the best medium, because of the difference in soly. Thus in C_6H_6N reduction takes place in presence of H_2 and $H_2N.NH_2$ (with Pt as the catalyst), SbH_3 , H_2S and $(NH_4)_2S$. The susceptibility to reduction increases with the no. of naphtho groups. Dehydrogenation also

proceeds more readily in the case of more complex mols. Dibinaphthyleneethane was slowly converted into the bifulvene by boiling with the acetates of Cu and Hg. Quinone dehydrogenates bisdinaphthofluorenyl in C_6H_5N . Cl_2 and Br_2 according to Graebe, convert fluorene into dibiphenyleneethene; the author notes similar behavior of I_2

toward hydrobifulvenes dissolved in boiling α - $C_{10}H_7Br$: $2 Ar_2CHI \xrightarrow{150^\circ} Ar_2CH-$
 $\xrightarrow{279^\circ} Ar_2C:CAr_2 + 2HI$.

• The reaction also proceeds in boiling C_6H_6N because of its catalytic properties. I_2 and Ag_2O do not act on bifulvenes in C_6H_5N , while atm. O_2 breaks the double linkage. Light and $MeOK$ accelerate the oxidation of bifulvenes by air. H_2O_2 and BzO_2H act upon dibiphenyleneethene only. $AmNO_3$ and NO_2 instantly decolorize solns. of all bifulvenes, addn. products being formed with NO_2 . Br_2 forms addn. product with dibiphenyleneethene which decomposes on heating; with the naphtho derivs. Br_2 enters the aromatic nuclei in the cold, the chromophore group remaining intact. VI. The absorption spectra of bifulvenes and the chromophore of indigo. *Ibid* 289-306.—The absorption spectra of 0.0003 and 0.00003 N bifulvene solns. in C_6H_6 were studied; $1/\lambda$ was plotted against \log_{10} of the thickness of layer at which absorption occurred. The bifulvene chromophore exhibits an absorptive capacity 200 times or more greater than that of the quinoid group, and can best be compared with the indigoids. The introduction of naphtho groups into dibiphenyleneethene shifts the absorption max toward the longer waves. This cannot be explained on the basis of Nitzky's rule, since the coloration disappears with additional benzo nuclei. Bifulvenes and the structure of indigoids.—There is a similarity between the synthesis of indigoids and bifulvenes, billuorenyls serving as the leuco compds. of the latter. The introduction of a substituent group results in similar color changes in the thionaphthene and fluorene series. The structural formulas of indigoids according to Claasz contain

groups $\dot{C}:C:C:N:C:N:C:C:C$ and $C:C:C:S:C:C:S:C:C:C$ resembling the bifulvene

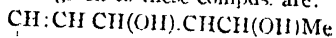
$\dot{C}:C:C:C:C:\dot{C}:C:C:C:\dot{C}$; on the assumption that the substitution of N or S does not destroy the color properties of bifulvene, this system of 5 double bonds becomes the chromophore of the simplest indigoids

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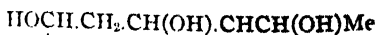
Isomerism of oximes. XXXI. The furfuraldoximes and 2-methoxy- and 4-methoxy-1-naphthaldoximes. O. L. BRADY AND R. F. GOLDSTEIN. *J. Chem. Soc.* 1927, 1959-64, cf. *C. A.* 21, 2257.—Furfuraldehyde (I) (13.5 g.), added slowly to a cold mixt. of 14 g. $NaOH$ in 15 cc. H_2O and 12 g. $NH_2OH \cdot HCl$ in 30 cc. H_2O , the soln. filtered after 1 hr., cooled and a slight excess of ice-cold satd. NH_4Cl soln. added, give 11.5 g. crude oxime, m. $51-64^\circ$, from which 3 crystals from C_6H_6 and light petroleum give 4 g. pure α -furfuraldoxime, m. $75-6^\circ$; boiled with C_6H_6 4 hrs., there results a mixt. of the α - and β -oximes; Ac deriv., m. $34-5^\circ$ and gives nearly pure α -oxime on hydrolysis; Bz deriv., m. $128-9^\circ$. $NH_2OH \cdot HCl$ (10 g.) in 40 cc. $MeOH$, treated with 19.5 g. cryst. $AcONa$ in 40 cc. dil. $EtOH$ and 12 g. I added, gives nearly quant. the β -oxime, m. $91-2^\circ$. $NH_2OH \cdot HCl$ (7.5 g.) and 10 g. $NaOH$ in 110 cc. H_2O treated with 14 g. 2- $MeOC_{10}H_7CHO$ in 20 cc. hot $EtOH$ gives almost quant. α -2-methoxynaphthaldoxime, m. $154-5^\circ$; Ac deriv., m. $79-80^\circ$, hydrolyzed to the α -oxime; the HCl salt is a bright yellow powder, m. $145-7^\circ$ (decompn.). MeI and $EtONa$ give mainly the O-ether, but a little N -methyl ether, m. $118-9^\circ$; hydrate, m. $88-9^\circ$; the O-Me ether, m. 65° . α -4-Methoxynaphthaldoxime, m. $107-8^\circ$; Ac deriv., m. 102° ; HCl salt, yellowish green, m. $144-5^\circ$ (decompn.); O-Me ether, m. $38-9^\circ$; N-Me deriv., yellow, m. $158-9^\circ$, changing to gray on standing in the mother liquor for 2 hrs.

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Digitoxose and anhydro-digitoxose. A. WINDAUS AND G. SCHWARZE. *Nachr. Ges. Wiss. Göttingen. Math. Physik Klasse* 1926, 1-7.—By sublimation at 0.03 mm. and $260-70^\circ$ digitoxin (I) yields anhydrodigitoxose (II) and an oily product, insol. in H_2O . II is purified by taking up the sublimate in H_2O and extg. I from the aq. layer with Et_2O ; long needles, m. 114° , yield 0.03 g. II from 1 g. I. By shaking with Pt and H_2 , II takes up 1 mol. H_2 , forming the dihydro deriv. (III), a colorless oil. By oxidation with perbenzoic acid in $AcOEt$ soln. at 25° a soln. of 0.38 g. II in 12 cc. $AcOEt$ gave 20% of methylpentose (IV), $C_5H_{12}O_6$, m. 116 , which reduced Fehling soln. and took up 1 mol. I_2 ; it formed a levo-optically active osazone with $PhNHNH_2$, m. 178° . The structural formulas given to these compds. are:



(II)



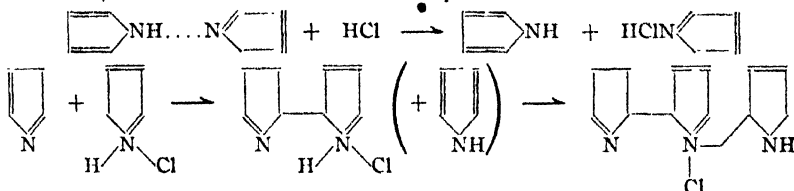
(IV)

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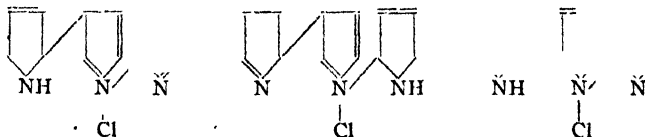
The osazone of IV is not identical with that from *d*- or *l*-rhamnose, *d*- or *l*-isorhamnose, fucose (rhodose), or epifucose (epirhodose). Digitoxose is thus given the formula IV. The metho-half-acetal of digitoxose Me ether (V) was prepd. by treating a soln. of 3 g. IV in a small amt. of H₂O with 30 g. Me₂SO₄ under const. agitation at 45° and with const. addn. of 30% NaOH to hold the soln. alk. to phenolphthalein; the temp. was then raised to 90° for a short time, the mass cooled and extd. with CHCl₃; the CHCl₃ was evapd. off from the ext. and residue distd. at 0.05 mm. at 100°; yield 2 g. of a clear oil (V). Digitoxitol (VI) is prepd. from IV by hydrogenation under cooling with 2.5% NaHg and dil. H₂SO₄; m. 88°, distils without decompn. in a high vacuum. The dibenzal deriv. of VI is prepd. by treating 0.5 g. VI with 1 g. PhCHO and 3 cc. 50% H₂SO₄; the violet soln. is treated with 5 cc. H₂O and after 3 hrs. at 15° the ppt. is filtered, taken up in hot MeOH and recrystallized; yield 1 g. colorless crystals, m. 142°.

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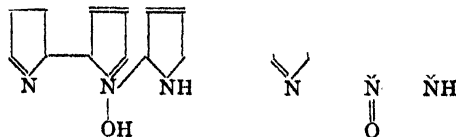
The polymerization of pyrrole. B. V. TRONOV and P. P. POPOV. *J. Russ. Phys.-Chem. Soc.* **58**, 745-58(1926).—Analysis of tripyrrole repptd. with ligroin from dry benzene, resulted in the formula C₁₂H₁₇N₃O; earlier investigators have also failed to isolate an O-free base. T. and P., therefore, offer a new structure for the HCl salt as a product of condensation of HCl and 3 pyrrole mols. in which Cl is attached to the H-free N. Liquid pyrrole is associated, possibly through the combination of the acid imino and a basic α or β form. The action of HCl can be represented as follows:



After examining a no. of other possibilities (since pyrrole can react in any of the 3 forms) 3 more formulas were found



which agreed with the chem. behavior of tripyrrole, *i. e.*, the formation of 2 mols. of α - α' azo compd. with azoxycarboxamides, and of (CH₂CO₂H)₂ upon oxidation. Furthermore, not more than 2 pyrrole nuclei can be recovered on breaking up tripyrrole. By the action of alkalis or NH₄OH upon the HCl compd. there is obtained a quaternary base which in faintly alk. soln. is rapidly transformed into red pyrrole (C₁₂H₁₄N₃O); red pyrrole was produced also on heating with 20% HCl besides a smaller amt. of brownish ppt. The decompn. is assumed to be analogous to the hydrolysis of pyridinium salts. When the soln. is shaken with CHCl₃ during the neutralization with NH₃, no red pyrrole seps. The free base recrystd. for analysis did not yield red pyrrole; its mol. wt. was 270 instead of 219 and reached 370 in a month. Soly. also varied on standing. •A migration of H to the α -carbon possibly takes place:



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Some derivatives of di(2-pyridyl)amine: tri(2-pyridyl)amine. J. P. WIBAUT and G. LA BASTIDE. *Verslag. Akad. Wetenschappen Amsterdam* **36**, 514-9(1927).—Nitration of di(2-pyridyl)amine by warming with H₂SO₄ and HNO₃ gives a yellowish brown *dinitro* deriv., m. 195-6°, which has very weak basic properties. Bromination in AcOH gives a yellowish orange *dibromo* deriv. *di-HBr* salt, m. 253-4°; *free base*, m. 191°. The position of the substituent groups was not detd. New halogenated

pyridines prepd. were 2-iodo-5-bromopyridine, m. 117°, by treatment of 2-amino-5-bromopyridine in 50% AcOH with KI and NaNO₂; 5-iodo-2-bromopyridine, m. 122.5°, by treating 2-amino-5-iodopyridine in concd. HBr with NaNO₂; 2,5-diiodopyridine, m. 154°, from 2-amino-5-iodopyridine with HI and NaNO₂; 2-iodo-3,5-dibromopyridine, m. 70.5°, from 2-amino-3,5-dibromopyridine, HI and NaNO₂. Attempts to prep. substituted dipyriddyamines by condensation of 2-amino-5-nitro- or 2-amino-5-bromopyridine with 2-halopyridines were unsuccessful. *Tri(2-pyridyl)amine*, m. 132.5° (*picrate*, m. 149°; *HgCl₂ salt*, m. 180°), was obtained in 10-20% yield by heating 1 mol. 2-aminopyridine with 2 mols. 2-iodopyridine in mesitylene with anhydrous KOH, Cu powder and KI, 14 hrs. at 150-60°. The Na deriv. of dipyriddyamine does not react with chloropyridine. Of the primary, secondary and tertiary pyridylamines, the secondary is the strongest base. In 15% EtOH, 0.01 *N* solns. of the 3 bases gave *p_H* values of 9.07, 9.41 and 7.40, resp. In its weak basicity the tertiary amine contrasts sharply with tertiary aliphatic amines.

A. W. DORR

The solubility of 1-phenyl-2,3-dimethyl-4-dimethylamino-5-pyrazolone in water. RAYMOND CHARONNAT. *Compt. rend.* 185, 284-6(1927).—The soly. diagram for this compd. (I) in H₂O is given. A second or β form of I exists at temps. above 70°, which presents a reciprocal soly. with H₂O with two crit. temps., a max. and a min. *sec.*-BuOH is the only similar example. The transformation into this β form of I at 65-70° explains the marked increase in the apparent soly. of the α form in this range. The pure β form has not been isolated.

D. H. POWERS

Triazoles. KARL BRUNNER. VIII. 1-Phenyl-3,5-dimethyl-1,2,4-triazoles substituted in the phenyl nucleus. FRANZ HERNLER. *Monatsh.* 48, 391-403(1927); cf. C. A. 21, 3200.—*p*-BrC₆H₄NHNH₂ (1 mol.) and 3 mols. Ac₂NH in AcOH, heated 20 hrs. on the H₂O bath, give after extensive purification 77.7% of 1-(*p*-bromophenyl)-3,5-dimethyl-1,2,4-triazole (I), b_p 176-8°, m. 93-4°; *picrate*, m. 166-7°. Heating I with excess concd. NH₄OH and Cu bronze 10 hrs. at 200-20° or reduction of the *p*-NO₂ deriv., gives the *p*-amino deriv. (II), m. 182.75-3.5°; *picrate*, m. 176.5-7.5°. II is converted into I through the diazo reaction (58.8% yield). The *p*-cyano deriv., obtained through the diazo reaction from II, or by heating I with KCN, CuCN and Cu bronze 10 hrs. at 230°, m. 68-70° (50% yield); *picrate*, yellow, m. 143.5-4°; sapon. with EtOH-KOH gives the *p*-carboxy deriv., m. 293-4° (64% yield); 1 part dissolves in 6300 parts cold and 1200 parts boiling H₂O; it does not give a ppt. with picric acid; the Na salt is easily sol. in H₂O. I does not react with the Grignard reagent; in 1 expt., from activated Mg and MeI there was obtained a product analyzing for a methiodide but having the properties of an HI salt.

C. J. WEST

Synthesis of pyrylium salts of anthocyanidin type. XII. D. D. PRATT, ALEX ROBERTSON and ROBT. ROBINSON. *J. Chem. Soc.* 1927, 1975-83; cf. C. A. 20, 3456.—BzCH₂CHO (2.9 g.) and 2.5 g. 1,3,5-C₆H₃(OH)₃ in 55 cc. HCO₂H give 5.1 g. of *tri-anhydrobenzoylacetalddehyde*phloroglucinol (I), orange-red, darkens 210-80° and then chars. Condensation of BzCH₂CHO and anhydrous 1,3,5-C₆H₃(OH)₃ in Et₂O by HCl gives poor yields of *chrysinidin chloride*(5,7-dihydroxyflavylium chloride) (II), reddish brown, crystg. with 2H₂O, darkens 250°, does not m. 300°; the yellow concd. H₂SO₄ or orange-red EtOH solns. do not fluoresce; II also results by boiling I for 6 hrs. with 2 vols. AcOH and 1 vol. concd. HCl; the anhydrous chloride results by carrying out the condensation in glacial AcOH; II also results from *O*-benzoylphloroglucinolaldehyde (III) and PhAc in AcOEt with HCl and satg. the soln. of the ppt. in MeOH with NH₃. *Chrysinidin perchlorate*, red, darkens 208°, m. 244° (decompn.). III and *p*-MeOC₆H₄Ac in AcOEt, satd. with HCl, give *O*-benzoylacacetinidin chloride, orange-red, crystg. with 1 H₂O; the EtOH soln. is orange or orange-red and exhibits strong green fluorescence. With MeOH and NH₃ it gives acetinidin chloride; with HI and PhOH this splits off MeI, giving *apigenidin chloride*(5,7,4'-trihydroxyflavylium chloride), light orange-yellow by transmitted light; the mass is bright salmon-red; crystg. with 1 H₂O, turns green at 230°, chars above 350°; *mercurichloride*, orange needles; *perchlorate*; *periodide*, dark brown. *Hydroxymethylenacetoveratrone*, oily (Cu salt, pale green, decomp. 188°) and 1,3,5-C₆H₃(OH)₃ with HCl give 5,7-dihydroxy-3',4'-dimethoxyflavylium chloride, reddish brown, decomp. 272°, crystg. with 1.5H₂O; aq. Na₂CO₃ gives an intense blood-red soln. With PhOH and HI for 30 min. there results a *mono-Me ether*, orange-red, decomp. 282°, crystg. with 0.5H₂O; it gives a Bordeaux-red to reddish purple soln. in aq. Na₂CO₃. Further heating with HI gives luteolinidin chloride. 7-Hydroxy-3,2',4'-trimethoxyflavylium chloride, crimson, darkens 140°, decomp. 185°; the color base is bluish red, a pseudo-base is readily formed and the yellow concd. H₂SO₄ soln. exhibits bright apple-green fluorescence. The corresponding tetrahydroxy deriv. (*resomarinidin chloride*), red decomp. 216°, crystg. with 1.5 H₂O. The Cu deriv. of *hydroxymethylene-*

2,4-dimethoxyacetophenone, pale green, m. 190° . *Et 2,4,6-trimethoxybenzoylpyruvate*, pale yellow, m. 84° ; in the solid state it forms a blue compd. with I. C. J. WEST

Factors controlling the formation of some derivatives of quinoline and a new aspect of the problem of substitution in the quinoline series. ELWYN ROBERTS AND E. E. TURNER. *J. Chem. Soc.* 1927, 1832-57.—The ease of condensation of substituted PhNH_2 with Ac_2CH_3 appears to be affected most by the basicity of the PhNH_2 used. The 2nd stage of the Combes quinoline synthesis (the intramol. condensation of an anil of Ac_2CH_3) is much more definitely affected by the nature of the substituents present. When a strongly *o-p* directing group is present in the *m*-position to the N atom in $\text{PhN}:-\text{CMeCH}_2\text{Ac}$, condensation proceeds readily, even if a similar group is present in an unfavorable position; on the other hand, a strongly *o-p* directing group present in position 4, in absence of other substituents in favorable positions, appears to be sufficient to prevent quinoline formation. In the condensation of the PhNH_2 with Ac_2CH_3 , 1 mol. of the PhNH_2 and 1.1 mols. Ac_2CH_3 were boiled gently for 1-2 hrs., H_2O was added to the cooled product and the condensation product isolated by extrn. with C_6H_6 . *p*- $\text{MeC}_6\text{H}_4\text{N}:\text{CMeCH}_2\text{Ac}$ m. $68-9^{\circ}$ (C. gives $39-40^{\circ}$, DRP 363,582, 65.5°); *β*-*o*-chloroanilinopropenyl *Me ketone*, m. $66-7^{\circ}$; the *β*-*p*-chloro deriv., m. $60-1^{\circ}$; the *β*-*m*-chloro deriv. (I), b_{11} 187° , m. 42° ; *o*-hydroxybenzylidene-3-chloroaniline, bright yellow, m. 99° ; *β*-2,4-dichloroanilinopropenyl *Me ketone*, m. 100.5° ; *o*-hydroxybenzylidene-2,4-dichloroaniline, brilliant yellow, m. 90.5° . *β*-2,5-Dichloroanilinopropenyl *Me ketone*, m. 46° (yield, very small); the *β*-3,5-dichloro deriv.* was not obtained crystd.; the *β*-3,4-dichloro deriv. (II), m. 73° ; *o*-hydroxybenzylidene-3,4-dichloroaniline, yellow, m. 113° . In the conversion of the anils into quinoline derivs., they were added slowly, as a fine powder or as a thin stream of liquid, to 6 times their wt. of concd. H_2SO_4 , cooled below 5° ; after soln. the mixt. was heated 0.5 hr. on the boiling H_2O bath. The anils from *o*- and *p*- $\text{ClC}_6\text{H}_4\text{NH}_2$, 2,4-, 2,5- and 3,5- $\text{Cl}_2\text{C}_6\text{H}_3\text{NH}_2$, *o*- $\text{MeOC}_6\text{H}_4\text{NH}_2$ and 3,6- $\text{Cl}(\text{AcNH})\text{C}_6\text{H}_3\text{NH}_2$ were not converted into quinoline derivs. I and H_2SO_4 , heated at $130-40^{\circ}$, give almost quant. 7-chloro-2,4-dimethylquinoline, m. $46.5-8.5^{\circ}$; hydrate, m. 61° ; *HCl* salt, m. 277° (decompn.); sulfate, rhombohedra; dichromate, brilliant yellow needles; AgNO_3 addn. compd., needles, m. 197° (decompn.); various attempts to synthesize this deriv. failed. 2,4-Dichloroacetophenone, b_{11} $140-50^{\circ}$, m. $33-4^{\circ}$. In only 1 expt. could II be converted into 6,7-dichloro-2,4-dimethylquinoline (IIa), m. $119-20^{\circ}$; *HCl* salt, m. 235° ; dichromate, yellow needles; chloroaurate, needles; AgNO_3 addn. compd., m. $218-9^{\circ}$; 8(?)*-nitro* deriv., m. 197° . Using the Beyer synthesis (*J. prakt. Chem.* 33, 393(1886)), which consists in heating the aniline with a suitable aged mixt. of paraldehyde, Me_2CO and *HCl* at 100° in the presence of PhNO_2 , *o*- $\text{ClC}_6\text{H}_4\text{NH}_2$ gives 25% of 8-chloro-2,4-dimethylquinoline (III), m. 74° ; it is unaffected by heating with piperidine for 1 hr. at 100° ; 5-nitro deriv., pale yellowish brown, m. $107-8^{\circ}$ (sulfate); 5-amino deriv., brown, m. $170-2^{\circ}$; through the diazo reaction, it is converted into the 5,8-di-*Cl* deriv.; chlorination of III gives a tetrachloro deriv., m. $150-2^{\circ}$. 6-Chloro-2,4-dimethylquinoline, m. $98-9^{\circ}$ (16% yield); hydrate, m. $84-5.5^{\circ}$; dichromate, orange-yellow; 5-nitro deriv., canary-yellow, m. $132-3^{\circ}$; 5-amino deriv., pale yellow, m. $131-3^{\circ}$; 5,6-dichloro deriv. (IV), through the diazo reaction, m. $119-20^{\circ}$; tetrachloro deriv., m. $75.5-81^{\circ}$. Nitration of IV gives the 8(?)*-nitro* deriv., m. $151-2.5^{\circ}$; 8(?)*-amino* deriv., m. $118-20^{\circ}$; this could not be converted through the diazo reaction into a tri-*Cl* deriv. Chlorination of III gives a tetrachloro deriv., m. $157-8^{\circ}$. 7-Chloro-2,4-dimethylquinoline is obtained in 36% yield by the Beyer method; 8-nitro deriv., m. $189-9.5^{\circ}$ (heated with piperidine for 0.5 hr., there results the 7-piperidino deriv., m. $168-70^{\circ}$); 8-amino deriv., pale yellow, m. $51-3^{\circ}$; through the diazo reaction there results the 7,8-dichloro deriv., m. $104-4.5^{\circ}$ (20% yield or less); trichloro deriv., m. 195° . 6,8-Dichloro-2,4-dimethylquinoline, 20% yield; 5(?)*-nitro* deriv., pale yellow, m. $122-3^{\circ}$; 5(?)*-amino* deriv., m. $194-5^{\circ}$; pentachloro deriv., m. $124-5^{\circ}$. 5,8-Dichloro-2,4-dimethylquinoline is obtained in 29% yields; 6-nitro deriv., m. $155-7^{\circ}$ (90% yield); 6-amino deriv., m. $192-3^{\circ}$ (40% yield); the diazo reaction gives a small amt of the 5,6,8-trichloro deriv. (V), m. $111-2.5^{\circ}$; direct chlorination gives the pentachloro deriv., m. $127-8^{\circ}$. In the prepn. of 5,7-dichloro-2,4-dimethylquinoline by the Beyer method, with a reagent 2 mos. old, there resulted a yellowish brown solid with 42% *Cl*, m. $168-9^{\circ}$, converted by NH_4OH into a 2nd substance contg. 35.6% *Cl* and m. $69-70^{\circ}$, which are being investigated. 2,4,5- $\text{Cl}_3\text{C}_6\text{H}_3\text{NH}_2$ in the Beyer method gives V. *o*- $\text{O}_2\text{NC}_6\text{H}_4\text{NH}_2$ gives a compd., m. $145-7^{\circ}$; *p*- $\text{O}_2\text{NC}_6\text{H}_4\text{NH}_2$ gives a compd., brown leaflets, m. $159-62^{\circ}$; *m*- $\text{O}_2\text{NC}_6\text{H}_4\text{NH}_2$ does not react; 3,6- $\text{Cl}(\text{O}_2\text{N})\text{C}_6\text{H}_3\text{NH}_2$ and 3,4,6- $\text{Cl}_3(\text{O}_2\text{N})\text{C}_6\text{H}_3\text{NH}_2$ give only tarry products. 3,4-Dichloroacetophenone, b_{11} 135° , m. 76° , in 40% yield from *o*- $\text{C}_6\text{H}_4\text{Cl}_2$, AcCl and AlCl_3 ; 2-nitro deriv., pale yellow, m. $100-2^{\circ}$; 2-amino deriv., yellow, m. $154-6^{\circ}$; heated with Me_2CO and NaOH 6 hrs. at 185° , IIa results. Nitration of 2,4-dimethylquinoline gives the 8-nitro deriv., brown, m. $118-9^{\circ}$ (98%

yield); *8-amino deriv.*, brownish yellow, m. 89–92°; *picrate*, yellow; *sulfate*, bright yellow; the diazo reaction gives the 8-Cl deriv. Bz_2CH_2 and freshly distd. PhNH_2 , boiled 9 hrs., give PhNHBz and a bright yellow compd., m. 102–3°.

C. J. WEST

Some new derivatives of 2-phenylquinoline-4-carboxylic acid (atophan). T. KAKU. *J. Pharm. Soc. Japan* No. 545, 577–84 (1927).—Some new derivs. of atophan were prepd. by Dobner and Gisek's method (*Ann.* 242, 265), and their physiol. action, chiefly that of uric acid elimination, was studied. For aldehydes, $\text{C}_6\text{H}_5\text{CHO}$ or *p*- $\text{MeOC}_6\text{H}_4\text{CHO}$ and for amines, $\text{Me}_2\text{C}_6\text{H}_4\text{NH}_2$ or $\text{Me}_2\text{C}_6\text{H}_3\text{NH}_2$ were condensed with AcCC_6H_4 in alc. soln. By decarboxylation of the resulting compds. by heating with soda-lime, the corresponding quinolines were prepd. The following are the new atophan derivs.: *6,8-dimethyl-2-phenylquinoline-4-carboxylic acid*, m. 237–8°; *6-methyl-2-p-methoxyphenylquinoline-4-carboxylic acid*, m. 230–1°; *7-methyl-2-p-methoxyphenylquinoline-4-carboxylic acid*, m. 200°; *8-methyl-2-p-methoxyphenylquinoline-4-carboxylic acid*, m. 233–4°; *6,8-dimethyl-2-p-methoxyphenylquinoline-4-carboxylic acid*, m. 239°. The highest uric acid eliminating power is possessed by the 8-Me deriv. followed by ordinary atophan, then decreases in the order 7-Me, 6-Me, 6,8-di-Me deriv. The following are the new quinoline derivs.: *7-Methyl-2-phenylquinoline*, m. 100.5°, *Pt salt*, decomps. 243–4°; *picrate*, m. 192°; *6,8-dimethyl-2-phenylquinoline*, m. 38.5°, *Pt salt*, decomps. 204–5°; *picrate*, m. 186–7°; *2-p-methoxyphenylquinoline*, m. 124°, *Pt salt*, decomps. 214°; *picrate*, m. 195°; *6-methyl-2-p-methoxyphenylquinoline*, m. 136°, *Pt salt*, decomps. 242–3°; *picrate*, m. 209°.

NAO UYEI

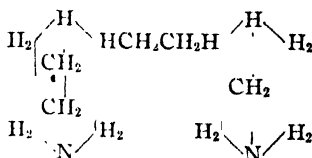
The destruction of amino acids and of amino purines by methylglyoxal and related substances. CARL NEUBER AND MARIA KOBEL. *Biochem. Z.* 185, 477–9 (1927).—If a mixt. of amino acid (alanine) and methylglyoxal is digested and distd., there is a violent production of CO_2 and of AcH resulting from deamination. This reaction takes place equally well in a H_2 or N_2 atm. as well as in air, and is therefore not dependent upon O_2 . The methylglyoxal is thereby used up.

S. MORGULIS

Lycoris bases. I. Sekisanine. I. H. KONDO AND K. TOMIMURA. *J. Pharm. Soc. Japan* No. 545, 545–9 (1927). Morishima (*Arch. exp. Path. u. Pharm.* 40, 221) has previously isolated 2 bases, lycorine and sekisanine (I) from the bulb of *Lycoris radiata* Herb. K and T have now made a detailed study of the properties of I, which were as follows: Mol. formula $\text{C}_{16}\text{H}_{19}\text{NO}_4$, colorless, m. 207–9°, $[\alpha]_D^{25}$, 114.6°; *hydrochloride*, silky luster, m. 211°, $[\alpha]_D^{25}$, 106.4°; *chloroplatinate*, m. 194°; *chloroaurate*, unstable; *diacetyl deriv.*, m. 72°; *methiodide*, m. 287°. Herzog and Meyer's method gives indication for the presence of 1-N-Me, but its presence is doubtful. H_2SO_4 soln. of I decolorizes Br soln. Gaebel's reaction for CH_2O_2 group is positive. Lycorine with Pt black and H_2 gives dihydrolycorine (II), m. 250°, $[\alpha]_D^{16}$, –57.14°; *hydrochloride*, m. 261°, $[\alpha]_D^{16}$, –16.4°; *nitrate*, m. 250°. I and II have the same compn., but are not identical.

NAO UYEI

Studies on sparteine. R. WOLFFENSTEIN AND J. REITMANN. *Biochem. Z.* 186, 269–77 (1927).—Expts. indicate that sparteine must be regarded as an unsymmetric base, probably of the following constitution.



S. MORGULIS

Synthesis of rutecarpine. II (Supplement). Y. ASAHINA, T. IRIE AND T. OHTA. *J. Pharm. Soc. Japan* No. 545, 541–5 (1927); cf. C. A. 18, 1667; 21, 3054.—Norharman (C. A. 21, 2134) with EtOH and Na gives *tetrahydronorharman* (I), colorless, m. 204–5°. *Picrate*, yellowish brown, m. 250–1°. I and *o*- $\text{O}_2\text{NC}_6\text{H}_4\text{COCl}$ in $\text{C}_6\text{H}_5\text{N}$ give *N-o-nitrobenzoyltetrahydronorharman* (II), bright yellow, m. 204°. Reduction of II by Zn dust to the hydroxylamine deriv. with the view of converting the latter into dihydro-rutecarpine was unsuccessful.

NAO UYEI

Constitution of coptisine, a new alkaloid from Coptis japonica. ZENJIRO KITASATO. *Bull. Imp. Acad. (Japan)* 2, 124–5 (1926).—Coptisine, $\text{C}_{19}\text{H}_{19}\text{NO}_6$, is best purified through the *tetrahydro deriv.*, m. 214–5°, from which it is recovered by oxidation with I. Oxidation with KMnO_4 gives hydrastatic acid. Coptisine, converted into a phenol base, fully methylated with Me_2SO_4 and then reduced with Zn and H_2SO_4 , gives palmatine. Therefore, coptisine is probably bismethylenedioxypseudoberberine.

C. J. WEST

Alkaloids of *Picralima klaineana*. T. A. HENRY AND T. M. SHARP. *J. Chem. Soc.* 1927, 1950-9.—The ground seeds were first extd. with petrol. ether and then with 96% EtOH; the dry alc. ext. was then extd. with 2% HCl and the mixed acid liquors shaken out with Et₂O and then diluted with H₂O as long as pptn. occurs, giving a weakly basic alkaloid or mixt. of alkaloids (A), from which no cryst. material has been obtained. The filtrate was then decolorized and treated with excess satd. Na₂CO₃ soln.; the dry ppt. was extd. with Et₂O, leaving some A; the Et₂O residue, extd. with twice its wt. of EtOH, gave a soln. of a 2nd amorphous alkaloid (B) and a partly crystd. residue (C). From another sample of seeds there was obtained a 2nd crystn. alkaloid (D). C is purified through the sulfate, from which excess Na₂CO₃ gives the free alkaloid, termed *akuamine* (I), C₂₂H₂₈O₄N₂, which contains 1OH, 1MeO and 1MeN group; I m. 255°, [α]_D²⁰ -66.7° (EtOH, ϵ 0.504), -73.4° (CHCl₃, ϵ 0.8716); the HBr salt crystals, with 1 H₂O, m. 228°, [α]_D²⁰ -26.05° (H₂O, ϵ 0.6076); the HCl salt crystals, with 1 H₂O, m. 227°, [α]_D²² -26.6° (H₂O, ϵ 0.8769), -32.8° (EtOH, ϵ 1.716); sulfate, (C₂₂H₂₈O₄N₂)₂·2H₂SO₄, crystals, with 10 mols. H₂O of which 9 are lost at room temp. *in vacuo* over CaCl₂, m. 221°, [α]_D¹⁹ -40.3° (H₂O, ϵ 2.0868); III salt, pale gray, m. 226°; nitrate, pale cream, m. 224°; thiocyanate, pale gray, m. 218°; perchlorate, m. 215°; picrate, brilliant yellow, m. 199°; picrolonate, yellow, decomp. 194°; on soln. in EtOH it deposits a deep blue dye. I.HCl reduces AuCl₃, PtCl₄ and AgNO₃ in the cold and Fehling soln. on warming. I.HCl gives a rose-red color with vanillin or piperonal and HCl, a yellowish brown color with Me₂NC₆H₄CHO, changing on long standing to red with a green fluorescence and with Br·H₂O a pink color. I and MeI in about 2 days gives a *methiodide*, m. 274°; the action of MeI and M-MeONa in MeOH gives an oily base, whose *picrate*, C₂₂H₂₇O₄N₂·Me·C₆H₄(O)₂N₃, bronze tinted prisms or canary yellow needles, m. 205°; I is apparently first hydrated by the alkali and the hydrate undergoes *O*-methylation. The *Ac* deriv. of I m. 226°, [α]_D²⁰ -52.08° (EtOH, ϵ 0.64); HBr salt, m. 236°; *picrate*, yellow, m. 168°. The action of alkali on I appears to give a *hydrate*, does not m. at 310° (15-41% yields). The alkaloid D m. 177.5°, [α]_D¹⁹ -737.5° (EtOH, ϵ 0.4932), -737.5° (CHCl₃, ϵ 0.3504); sulfate, m. 161°, [α]_D^{14.5} -594.1° (H₂O, ϵ 0.4226), -539.8° (H₂O, ϵ 0.2860), contg. 8.9% H₂O of crystn., of which 2.4% is lost *in vacuo*; nitrate, m. 180-1°; *picrate*, dull yellow, m. 169°; D gives a grass-green color when a mere trace is added to a drop of concd. HNO₃; it gives an indigo blue color with vanillin and a magenta color with piperonal, both changing to bright ultramarine blue after a few days and remaining stable for at least 14 days. The alkaloid gives no color with Gacbel's test for CH₂O₂ groups.

C. J. WEST

Synthesis of the homologs of zingerone. II. HOROSHI NOMURA AND SHUNJI TSURUMI. *Science Repts. Tohoku Imp. Univ.* 16, 565-79(1927).—The authors prepd. a series of 4-hydroxy-3-methoxyphenylethyl alkyl ketones and thci¹ derivs. in the course of studying the constitution of dihydroshogaol. Condensing C₆H₅COMe (26 g.) and vanillin (I) (30 g.) in 500 g. of alc. and 60 g. of KOH (1:1) for 6 hrs. under reflux, acidification and extrn. with Et₂O, gives by crystn. from Et₂O and ligroin 4-hydroxy-3-methoxystyryl hexyl ketone (II), m. 48-9°. Reducing II with Na-Hg in aq. soln. gives 4-hydroxy 3-methoxyphenylethyl hexyl ketone (III), b_p 193-4°. The derivs. prepd. were: Bz, m. 74-5°; the 3,4-dimethoxy, m. 32.7-33.7°; the oxime, m. 88-9°; and semicarbazone, m. 97.5-99°. 4-Hydroxy-3-methoxyphenylethyl heptyl ketone (IV), m. 30-31°, was prepd. in a manner similar to III by condensing I with C₇H₁₅COMe to give 4-hydroxy-3-methoxystyryl heptyl ketone, m. 42-3°, which was reduced to IV. The following derivs. were prepd.: Bz, m. 63-4°; semicarbazone, m. 103.5-4.5°; 3,4-dimethoxyphenylethyl heptyl ketone (V), m. 34-5°; oxime of V, m. 79.5-80.5°; semicarbazone of V, m. 82.5-3.5°. C₈H₁₇COMe with I gives 4-hydroxy-3-methoxystyryl octyl ketone, m. 45.5-6.0°. On reduction it gives 4-hydroxy-3-methoxyphenylethyl octyl ketone (VI), m. 35.5-36.5°; Bz deriv., m. 45-6°; 3,4-dimethoxy deriv. (VII), m. 45-6°; oxime of VII, m. 79.5-80°; semicarbazone of VII, m. 86-7.5°; 4-hydroxy-3-methoxyphenylethyl nonyl ketone (VIII), m. 42.5-3.5°, was reduced from the styryl deriv., m. 55.5-6.5°. Bz deriv. of VIII, m. 51-2°; 3,4-dimethoxy deriv. (IX), 33.5-5°; oxime of IX, 73.5-4.5°. D. H. P.

Constitution of gentisin. JUNZO SHINODA. *J. Chem. Soc.* 1927, 1983-5; see C. A. 21, 2270.

C. J. WEST

Vegetable coloring matters. I. Constitution of some anthocyanidins. P. KARRER AND R. WIDMER [in part with H. HÜRLIMANN AND O. NIEVERGELT]. *Helv. Chim. Acta* 10, 5-33(1927).—Hydrolysis of anthocyanins with 10-15% NaOH or Ba(OH)₂ proceeds readily on boiling, and the acid product of fission, with MeO groups intact, may be isolated in the usual way. When enin, myrtillin, althein, ampelopsin and

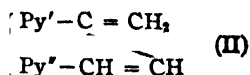
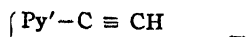
malvin, or the corresponding anthocyanidins (cf. Willstätter, *C. A.* 9, 1302), are treated in this way, pure 4,3,5-HO(MeO)₂C₆H₂CO₂H is obtained in each case in 10-35% yield. Accordingly, these substances must all be derived from the anthocyanidin, 5,7,4'-trihydroxy-3',5'-dimethoxyflavylium chloride, for which the name *syringidin* is proposed, and the differences in their properties must be due to the presence of impurities. Malvidin is shown by analysis to be a pure compound, identical with syringidin. Enin, which is conveniently purified by repeated recrystn. of the picrate from boiling H₂O, contains less than the theoretical amt. of MeO, and is, therefore, not a pure compd. Enidin chloride can be sepd. by fractional crystn. from 7% H₂SO₄ into more and less sol. fractions, of which the latter has a higher MeO content than the original material and a soly. of the same order as that of malvidin chloride. The dark red blooms of *Cyclamen persicum*, Mill., contain a monoglucoside, *cyclamin*, isolated as the *picrate*, C₂₈H₂₇O₁₉N₃, which yields enidin on hydrolysis with acids and is probably identical with enin. Penoidin is hydrolyzed by 16% NaOH, giving cryst. vanillic acid. This confirms the formula of Nolan, Pratt and Robinson (*C. A.* 20, 3457). Since cyanilidin also yields vanillic acid on hydrolysis, it must be identical and not isomeric with peonidin. Myrtillin, regarded by Willstätter as a galactoside of delphinidin Me ether, is resolved by means of its picrate into two fractions. The more sol. is MeO-free, and is hydrolyzed by acids to delphinidin and a mixt. of dextrose and galactose. The less sol. fraction increases in MeO content on repeated recrystn. and corresponding changes take place in its cryst. form and FeCl₃ reactions. After 31 crystns., the product contains dextrose, but no galactose, and has a MeO content of 7.7% [1(OMe) = 6.3%]. Although apparently homogeneous, it is undoubtedly a mixt. of the glucosides of syringidin and delphinidin. Whether a delphinidin Me ether is also present is not certain. The great difficulty encountered in sepg. this mixt. accounts for its being previously regarded as a pure compd. On acid hydrolysis, it affords myrtillidin, which is identical in every respect with an artificial mixt. of syringidin and delphinidin. Althein is hydrolyzed to dextrose and altheidin, which, although it corresponds in compn. with a delphinidin Me ether, is actually, like myrtillidin, a mixt. or loose mol. compd. of delphinidin and its di-Me ether. When ampelopsin is purified through the picrate, its MeO content becomes much higher than that of the product described by Willstätter, and it is indistinguishable from enin. The various reactions which these substances show with alc. FeCl₃ may now be correlated with their syringidin content; thus malvin, a pure syringidin deriv., gives no reaction, enin, cyclamin and ampelopsin (80-90% pure) give a reddish violet color while the diff. fractions of myrtillin (50% or less pure) give colors ranging from wine-red to pure blue as the MeO content decreases.

B. C. A.

Oxazinesulfonic acids. J. S. TURSKI, J. BOJANOWSKI, K. MONIUSZKO AND J. VOGELGARN. *Rocz. Chem.* 6, 747-55(1926).—An acid dye, staining wool indigo-blue, (6-naphthylphenoxazinesulfonic acid, is prepd. by the action of Schaeffer's salt on nitroso dimethylaniline-HCl, while a pure blue dye with similar properties is obtained by condensation of the latter substance with β -naphthol-8-sulfonic acid, and with Na *p*-phenylsulfonate a gray dye, fast for mordanted cotton, but not for wool, is obtained.

B. C. A.

Porphyrins. XIII. The chemism of porphyrin formation and the constitution of hemin. WM. KÜSTER AND KARL SCHLAYER. *Z. physiol. Chem.* 168, 294-314(1927); cf. *C. A.* 21, 385.—Two possibilities have been suggested for the arrangement of the unsatd. side chains in hematoporphyrin, Py' and Py'' representing adjacent pyrrole groupings:



II is now shown to be the more probable for the following reasons: the substance adds 2 halogen acids instead of 3; after addn. of 2 halogen atoms 2 halogen acids may still be added; if Cl is added first and then HBr and half of the halogen replaced by MeO, oxidation by CrO₃ then yields 2 imides, one contg. Cl and the other Br. A. W. DOX

Jegosaponin. C. MATSUNAMI. *J. Pharm. Soc. Japan No.* 545, 557-71(1927).—Asahina and Momoya (*C. A.* 8, 3614) obtained by the hydrolysis of jegosaponin (I), jegosapogenin (II) glucuronic acid (III), and glucose (IV). M. shows that the amt. of III estd. by the 1,3,5-C₆H₃(OH)₃ method gives approx. double the amt. obtained by CO₂ method, the excess being due to the presence of rhamnose (V). The hydrolytic products were II 48.8, III 15.42, V 13.03, and IV 28.61%. Zn distn. of I gave a ter-

pene, $C_{10}H_{16}$, b_{18} 100–25°, a sesquiterpene, $C_{15}H_{24}$, b_{18} 160–7° and a polyterpene. Boiling I in HNO_3 gave a compd. $C_6H_{10}O_4$ which resembles *sym.*-dimethylsuccinic acid.
NAO UYEI

The glucosides of *Fatsia japonica* (OHTA) 11A.

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PORTER, CHARLES WALTER, STEWART, T. D., AND BRANCH, G. E. K.: *The Methods of Organic Chemistry; a Laboratory Manual*. Boston: New York: Ginn & Co. 311 pp.

STELZNER, ROBERT: *Literatur-register der organischen Chemie geordnet nach M. M. Richters Formelsystem*. Vol. V, 1919–21. Berlin: Deutschen chemischen Gesellschaft, Verlag Chemie. 1773 pp. Reviewed in *New Tech. Books* 11, 26 (1926); cf. *C. A.* 19, 1575.

Anthraquinone derivatives. I. G. FARBENINDUSTRIE AKT.-GES. Brit. 262,191, Nov. 28, 1925. 1-Diazoanthraquinone-2-carboxylic acids are made by treating the nitrogenous anthraquinone derivs. obtainable by the process described in Brit. pat. 147,001 (*C. A.* 14, 3675) with HNO_3 or compds. liberating HNO_3 in the presence of H_2O ; *e. g.*, anthraquinone-1,2-isoxazole and its 5-nitro deriv. are treated with nitrosylsulfuric acid and H_2O is added, or with N oxides in concd. HCl or is suspended in $NaNO_2$ soln. and HCl added. Solns. of the diazonium sulfates or chlorides are thus obtained. Anthraquinone-2-carboxylic acid derivs. can be obtained from the diazonium compds. by the use of HCl and Cu_2Cl_2 and the diazo compds. may be used for producing dyes. Cf. *C. A.* 21, 1273.

Diarylguanidines. CHEMISCHE FABRIK AUF AKTIEN VORM. E. SCHERING. Brit. 262,155, Nov. 30, 1925. Sym. diarylguanidines are prepd. by reacting with an excess of an arylamine such as aniline or *o*-anisidine on a salt of an isothiourea ether; *e. g.*, *S*-ethylisothiourea-HBr or *S*-methylisothiourea-HI or *S*-benzylisothiourea-HCl is heated with $PhNH_2$ in excess in the presence of a little H_2O until mercaptan is no longer evolved; on rendering the soln. alk., sym.-diphenylguanidine seps. Sym.-di-(*o*-methoxyphenyl)-guanidine-HBr is similarly obtained from *S*-ethylisothiourea-HBr and *o*-anisidine.

Organic acids. I. G. FARBENINDUSTRIE AKT.-GES. Brit. 262,101, Nov. 27, 1925. Monocarboxylic acids are obtained by passing the vapors of dicarboxylic acids, alone or with H_2O vapor, or the vapors of dicarboxylic acid anhydrides together with H_2O vapor, at an elevated temp. over catalysts capable of splitting off CO_2 . Among the catalysts which may be used are: Na_2CO_3 , $CaCO_3$, oxides of Zn, Cd, Pb, Bi, Si, Al, Ti, Fe and Ni, granulated Al and bauxite. Temps. of 300–450° are preferable. Benzoic acid is obtained by blowing superheated steam through fused phthalic anhydride and conducting the resulting gaseous mixt. over $CaCO_3$, or by passing N satd. with H_2O vapor and phthalic anhydride vapor over a mixt. of the oxides of Bi and Al deposited on pumice, or over activated Fe oxide. Maleic anhydride vapor together with H_2O -satd. N, when passed over active silica gel, yields acrylic acid. Propionic acid is similarly obtained from succinic acid. Products of oxidation of C_6H_6 vapor with air and V oxide, mixed with N and steam and passed over active silica gel or activated ZnO, yield a mixt. of benzoic acid and phthalic acid and anhydride. The "activated ZnO" may be prepd. by spraying a soln. of $Zn(NO_3)_2$ with nitrates of other metals on pumice and heating the product in a current of air.

Insoluble aliphatic acids. J. LEFRANC. Can. 273,539, Aug. 30, 1927. Aliphatic acids are obtained from their alkali and alk. earth salts by treating such salts with HCl, the aliphatic salt being in slight excess, and sepg. by a decantation process the soln. of chloride produced from the major part of the insol. aliphatic acids.

Sulfonic acids. K. DACHLAUER and E. THIEL. Can. 271,591, June 14, 1927. Aromatic sulfonic acids with ethyl or methyl substituted in the ring are prepd. by causing $EtOH$ or $MeOH$ and a strong sulfonating agent (oleum and chlorosulfonic acid) to act upon aromatic hydrocarbons at an elevated temp.

2-Hydroxy-3-bromo-5-pyridinearsonic acid. A. BINZ and C. RÄTH. Can. 273,-098, Aug. 16, 1927. 2-Hydroxy-5-pyridinearsonic is directly brominated.

Catalytic dehydrogenation processes. I. G. FARBENINDUSTRIE AKT.-Ges. Brit. 262,120, Nov. 30, 1925. Sulfides such as those of Cu, Ni, Co, Fe, Al, Cd, Ca and Mg are used as catalysts, *e. g.*, in the production of isobutyraldehyde from isobutyl alc., isovaleraldehyde from isoamyl alc., cymene from turpentine, isobutyronitrile from isobutylamine, or in other similar dehydrogenations.

Dehydrogenating alcohols. I. G. FARBENINDUSTRIE AKT.-Ges. Brit. 262,086, Nov. 27, 1925. In dehydrogenating isobutyl alcs or other "higher aliphatic alcs.," as by passage over heated ZnO, most of the resulting aldehydes or ketones are first condensed from the gaseous product and the latter is then washed with the alc. to be dehydrogenated to free the H from other products.

Methanol. C. L. GABRIEL and B. K. BROWN. Can. 271,569, June 14, 1927. MeOH is produced by passing a gaseous mixt. consisting of 1 vol CO and 5 vols. H₂ over a Cu-Zn alloy catalyst contg. some oxides, at 280° and at a pressure of about 20 atms.

Methanol. H. DREYFUS. Brit. 262,494, June 13, 1925. Water gas or other suitable gas mixt. contg. CO and H₂ in equimol. proportions is passed at high temp. and pressure over ZnO without addn. of other MeOH-forming catalysts. A pressure of 50-150 atm. is preferred and a temp. of 200-300° but the pressure and temp. may rise as high as 200 atm. and 450°. A Cu line or Al app. is preferably used. If the gases are passed through the app. at too low a speed, hydrocarbons and higher alcs. predominate in the product.

Dinitroperylene-3,10-quinone. A. ZINKE. U. S. 1,642,263, Sept. 13. This compd., which dyes cotton from the vat violet, is made by further nitration of mononitroperylene-quinone.

Ketene. H. DREYFUS. Brit. 262,364, June 13, 1925. A mixt. of CO and H₂ in the proportions of 3:1, resp., is passed over a MeOH-forming catalyst such as ZnO, Cu oxide, Cu chromate, Zn chromate, Zn aluminates, K zincate or various specified mixts. which may contain KOAc or K₂C₂O₄ or similar compds. Pressures of about 50-150 atm. and temps. of 200-300° are preferred.

Methyl formate. MARTIN MUGDAN and JOSEPH WIMMER. U. S. 1,642,689, Sept. 20. CH₂O vapors are passed in contact with finely divided Cu heated to 110-250°.

Benzene hydrocarbons. R. WIETZEL and C. PFAUNDLER. Can. 273,210, Aug. 16, 1927. Hydrocarbons of the benzene series are produced by converting gaseous olefins under elevated pressure and at a temp. of 300-500° into liquid hydrocarbons and subjecting the latter to catalytic dehydrogenation at temps. above 500°.

Cobalt and nickel acetates. I. G. FARBENINDUSTRIE AKT.-Ges. Brit. 262,075, Nov. 27, 1925. Co(OAc)₂ is made from "cobaltic oxyhydrate" and HOAc by the addn. of reducing agents and heating in a closed vessel to above the b. p. Alc. and Co are suitable reducing agents. Ni acetate can be similarly formed.

Nitro compounds. A. RASOUMEEFF. Brit. 262,097, Nov. 24, 1925. In producing PhNO₂ from C₆H₆ or in other nitrations of aromatic hydrocarbons or their substitution products, nitration is effected by the use of N peroxide in the presence of H₂SO₄.

Condensation products of methylolureas, etc. G. WALTER. Brit. 262,148, Nov. 28, 1925. Methylol compds. of acids amides such as acetamide, urea or thiourea are prep'd by the interaction of non-aq. CH₂O with the acid amide in an org. solvent such as MeOH, EtOH or benzyl alc. The presence of a base is necessary if the CH₂O is not acid-free and is otherwise advantageous as an accelerator of the reaction. The product is ppt'd. by ether or CCl₄. Several detailed examples are given.

Symmetrical carbonyl urea of *m*-(*m*-aminobenzoylamino)-*p*-hydroxybenzene-*arsonic* acid. W. SCHOELLER and M. GEHRKE. U. S. 1,642,830, Sept. 20. This compd., a yellow amorphous powder sol. in alkalies but insol. in the usual org. solvents, is made by aminobenzoylating *p*-hydroxy-*m*-aminobenzene-*arsonic* acid and treating the reaction product, in alk. soln., with phosgene, without cooling.

Primary amine. W. REPPE. Can. 273,516, Aug. 30, 1927. Primary amines are produced by passing a vaporized NH₃ compd. of an aldehyde mixed with H₂ and gaseous NH₃ at an elevated temp. over a hydrogenation catalyst.

Cyclohexylamines. I. G. FARBENINDUSTRIE AKT.-Ges. Brit. 261,764, Nov. 19, 1925. Primary or secondary amines are subjected to reaction with halogen cyclohexanes, preferably in the presence of a catalyst or an acid-binding substance. Aniline, 2 mol. proportions, is boiled in the presence of a little Cu with bromocyclohexane or chlorocyclohexane 1 mol. proportion. On cooling and acidifying with HCl, a ppt. of monocyclohexylaniline-HCl is formed. Toluidine, naphthylamine, chloroaniline, mono-

methylaniline, diphenylamine and carbazole may be similarly treated. By using 2 mol. proportions of bromocyclohexane and adding 1 mol. proportion of NaOAc, a dicyclohexylaniline is produced. Several other examples are given.

Cyclohexylamines. I. G. FARBENINDUSTRIE AKT.-GES. Brit. 261,747, Nov. 17, 1925. Cyclohexylethylaniline or other tertiary amines contg. a cyclohexyl group and an alkyl group are obtained by the action of alkylating agents on cyclohexylarylamines, e. g., by the action of Et_2SO_4 on cyclohexylaniline.

11—BIOLOGICAL CHEMISTRY

PAUL E. HOWE

A—GENERAL

FRANK P. UNDERHILL

Gastric secretion during "Chloralose" narcosis. A. ELKELES. *Arch. Verdauungs-Lehrh.* 40, 380-93(1927).—The stimulation usually caused by histamine is checked by "Chloralose." It did not interfere with the action of alcohol, pilocarpine or "Hydrophepin."

FRANCES KRASNOW

Hydrolysis of peptone, albumin and casein with normal sodium hydroxide. I. S. YAICHNIKOV. *J. Russ. Phys.-Chem. Soc.* 58, 1374-6(1926).—One % solns. of peptone, albumin and casein in N NaOH were decompd. in 25 days at 10° and 9-12 hrs. at 37° , 70° and 100° . Samples of 5 cc. were taken on certain days (at 10°) or hrs. They were first neutralized with N HCl, later with $0.2 N$ HCl, with phenolphthalein as indicator and finally titrated by "Sorensen's" method. Results were calculated to one cc. Peptone and casein are decompd. faster by NaOH than by acid (cf. *C. A.* 19, 3100). Albumin is decomposed by both alike. The decompn. of peptone agrees more or less with the rule of Schütz and Borisov, albumin only at 37° , casein only at 37° and 70° .

A. A. BOEHLINGK

The behavior of salivary diastase of man and various domestic animals toward glycogen. WILHELM LÜCKING. *Deut. tierarztl. Wochschr.* 34, 257-9; *Chem. Zentr.* 1926, I, 3404.---Glycogen is subjected to an amylolytic action only by the salivary diastase of omnivorous animals (man and swine), no evidence of a diastatic action of the saliva of herbivorous animals being found. The diastatic power of the saliva was greatest in a slightly acid medium.

C. C. DAVIS

The saproporphyrins. Copratoporphyrin, a frequent product of putrefaction of flesh and organs rich in blood. O. SCHUMM. *Z. physiol. Chem.* 169, 3-9(1927).—According to H. Fischer (*C. A.* 18, 2717), putrid meat and animal organs contain coproporphyrin, a substance derived from a hypothetical hemoglobin B. Expts. are now described in which horse meat and beef hearts were allowed to putrefy spontaneously for weeks and months. Considerable quantities of saproporphyrins developed, but in only 1 case was there the slightest suggestion of a positive coproporphyrin test. Copratoporphyrin, on the other hand, was uniformly present in considerable amt. This substance was probably mistaken by Fischer for coproporphyrin. Neither copratoporphyrin nor saproporphyrin D was known at the time of Fischer's work. The hypothetical hemoglobin B lacks all exptl. support.

A. W. DOX

Saproporphyrins. A new saproporphyrin. I. O. SCHUMM. *Z. physiol. Chem.* 169, 52-8(1927).—A hitherto unknown natural porphyrin was obtained from putrefied meat and beef heart as well as from putrefied blood, and designated *saproporphyrin D*. In Et_2O it gives approx. the same spectrum as coproporphyrin, Nencki's hematoporphyrin, acetylhematoporphyrin and the Me ether of Nencki's hematoporphyrin. In its chem. behavior it shows considerable similarity to copratoporphyrin but differs spectroscopically from the latter. Its soly. in CHCl_3 and its unusual color reaction with Br distinguish it from coproporphyrin. Its solns. in CHCl_3 , $0.1 N$ NaOH or 25% HCl rapidly fade in sunlight—a distinction from mesoporphyrin, coproporphyrin and copratoporphyrin. It has not yet been obtained in cryst. form, but little doubt remains that the substance represents a new natural porphyrin.

A. W. DOX

The catalytic hydrogenation of hemateric acid and hemin. ARNO PAPENDIECK. *Z. physiol. Chem.* 169, 59-63(1927).—When hydrogenated in AcOH soln. in the presence of colloidal Pd, hemateric acid takes up 6 H and yields mesoporphyrin. By similar treatment of hemin in AcOH addn. of 6 H occurs and at the same time a partial removal of Fe so that both mesohemin and mesoporphyrin are formed. In $0.1 N$ KOH, however, hemin gave in some expts. a complete conversion into mesohemin, in others

a product which was converted by the $\text{AcOH-N}_2\text{H}_4$ treatment into hemateric acid instead of mesoporphyrin. A. W. DOX

Pyridine-hemins. ANT. HAMSÍK. *Z. physiol. Chem.* 169, 64-72(1927).—When chlorohemin is dissolved in pyridine an addn. of the base to the halogen-Fe group occurs. Other hemins, e. g., acetyl-, formyl-, oxalyl- and sulfate-hemin, behave in the same way, yielding addn. products which may be designated by the general term pyridine-hemins. The pyridine soln. of chlorohemin when treated with Et_2O gives a sepn. of large crystals which on washing with Et_2O or EtOH break up into smaller crystals, the final product being the original chlorohemin. Treatment of the pyridine soln. of acetylhemins with Et_2O gives a sepn., partly amorphous and partly cryst., consisting of a mixt. of hydroxyhemins and hydroxyhemins anhydride. Oxalyl- and sulfate-hemin undergo a similar cleavage and for that reason cannot be obtained pure. These acylhemins in pyridine soln. differ from chlorohemin in their behavior on boiling. They give a cryst. sepn. of hydroxyhemins and its anhydride, whereas chlorohemin remains in soln. A. W. DOX

Comparative measurements of oxido-reduction and of carbon dioxide evolution by yeast enzymes. RAGNAR NILSSON AND BRITA JANSSON. *Z. physiol. Chem.* 169, 73-90(1927).—The ratio of ymase activity to reductase activity was detd. by comparing the no. of cc. of CO_2 evolved per hr. with the no. of min. required for decolorization of methylene blue. It was already known that fermenting power may drop to zero without any considerable decrease in reducing power. The problem consists therefore in establishing conditions under which the above ratio reaches a max. One of these conditions is the maintenance of cozymase factors in adequate amt. For 4 preps. of the same yeast the ratio was by no means const., but varied from 11.2 to 20.8. Correction being made for the difference in temp. at which the 2 detns. were made (20° and 30° , resp.) the actual ratios become half these values. Neither the fermentation nor the methylene blue reduction is activated by very small concns. of adrenaline. Catalase is present in the yeast preps. but probably has no influence on the reduction. Activation of the reduction by tetrahydro- β -naphthylamine occurs only with fresh yeast. The effect is greater at pH 8.2 than at pH 5, i. e., the free base is more effective than its HCl salt. The concn. producing the max. acceleration is 2×10^{-2} with fresh yeast, whereas the optimum concn. for activation of rabbit muscle is 10^{-4} . Fermentation, on the other hand, is not activated in either fresh or dried yeast. The amine is not utilized as a H-donor by the mutase nor can it replace the coenzyme. Small concns. of *o*- and *m*- $\text{C}_6\text{H}_4(\text{NH}_2)_2$ did not activate the methylene blue reduction by washed dried yeast. Fermentation is not affected by 0.000125 *M* picric acid, but higher concns. are inhibitory. A. W. DOX

Chemistry of the blood pigment. VI. The relations between hemin, hemochromogen and porphyrin. FELIX HAUROWITZ. *Z. physiol. Chem.* 169, 91-101(1927); cf. C. A. 21, 1661.—In the presence of AcOH both Fe^{++} and Fe^{+++} salts convert porphyrins into the corresponding hemins. On the other hand, if PrCO_2H or BuCO_2H is used in place of AcOH , only Fe^{++} can be introduced. The change from the hemochromogen spectrum to the hematin spectrum when a hemochromogen soln. is acidified does not occur in the complete absence of oxidizing agents. The formation of hemochromogen from chlorohemin is brought about by reducing agents even in the complete absence of O-contg. substances. Loss of OH rather than addn. of H accounts for the conversion of hemin into hemochromogen, and the latter should therefore contain only the 4 carboxyl-O atoms and not a 5th O atom. A. W. DOX

Origin of substances produced by irradiation of the heart. H. ZWAARDEMAKER. *Verlag Akad. Wetenschappen Amsterdam* 36, 448-50(1927).—By Ra or Po irradiation of an isolated heart which has stopped beating for lack of K, substances are produced which may be made to pass over into a perfusion liquid and which have the power of starting the beating of another heart similarly treated. These substances may be designated *automatins*. The β -automatin is the naturally occurring product which is formed from a parent substance, *automatinogen*, by the activation. The perfusion liquid obtained from a non-beating heart acquires the same activity when irradiated separately as that obtained from an irradiated heart. The substances are also present in skeletal muscle, since alc. exts. after adsorption on talc and subsequent extn. by EtOH show a similar activity, which is still further increased by irradiation, i. e., by activation of the parent substance simultaneously present. A. W. DOX

Studies on the action of rennet. E. MUNDINGER. *Milchwirtschaft. Forsch.* 4, 369(1927).—Three rennets were studied with variation in acidity and pH . The results check with the calcn. by the formula of Grimmer and Kruger (C. A. 20, 1998).

G. R. GREENBANK

Organic matrix in dental enamel of the guinea pig and rabbit. T. D. BECKWITH AND ADRIENNE WILLIAMS. *Dental Cosmos* 69, 912-20(1927).—The enamel of the incisor teeth of the rabbit and guinea pig contains an org. matrix which is characterized by certain microchemical reactions, e. g., staining by either picric acid or hematoxylin.

JOSEPH S. HEPBURN

Effect of γ -irradiation on cell division in tissue culture in vitro. R. G. CANTI AND F. G. SPEAR. *Proc. Roy. Soc. (London)* B102, 92-101(1927).— γ -Radiation lacks stimulating action on cell division, but has a definite effect in reducing the number of cells in mitosis in tissue cultures in vitro. However, the action of Ra is not purely cumulative, and there is a min. threshold of intensity, below which a given biological effect will not occur however long the period of exposure.

JOSEPH S. HEPBURN

The distribution of lymphatics defined by fatty acid compounds developed in the autolysis of their contents. J. L. SMITH AND THEODORE RETTIE. *Proc. Roy. Soc. (London)* B102, 102-9(1927).—The anatomical form and arrangement of the lymphatics of the liver are revealed by the post-mortem autolytic changes in the lymph, as a result of which doubly refractile globules of "soap" are formed from the lipins of the lymph, frequently in such quantity that they fill the lumen of the channel completely.

JOSEPH S. HEPBURN

The lipolytic and liposynthetic actions of dried pancreatic juice. C. ARTOM. *Arch. fisiol.* 24, 24-69(1926); *Physiol. Abstracts* 11, 590.—The desiccated secretion of dog pancreas has a distinct lipolytic and liposynthetic activity if redissolved in the proportion of 5% in water and glycerol. Both activities are favored by an excess of glycerol. The same desiccated secretion is affected by heat only when exposed for 30 min. to temps. a little above 82°.

E. H.

The lipolytic and liposynthetic actions of pancreas extract. S. DI FRISCO. *Arch. fisiol.* 24, 70-86(1926); *Physiol. Abstracts* 11, 590.—Dog pancreas can be extd. by means of a mixt. of water and glycerol; after desiccation an ext. so prepd. preserves a considerable lipolytic and liposynthetic activity corresponding to 20% free oleic acid and 80% esterified oleic acid.

E. H.

The behavior of maggots against poisons. K. FRIST. *Z. Untersuch. Lebensm.* 52, 466-9(1926).—The occurrence of maggots in forensic material contg. strychnine led to a further study. Finely ground horse meat was exposed. The maggots, which developed were then transferred to other portions of horse meat treated with various poisons. The following compds. were non-poisonous to maggots: chrome alum $\text{Sn}(\text{NH}_4)_2\text{Cl}_6$, atropine sulfate, colchicine, morphine-HCl, CH_3OH , phenol, $(\text{NH}_4)_2\text{C}_2\text{O}_4$, strychnine-HCl. The following compds. were poisonous: $\text{Pb}(\text{AcO})_2$, $\text{K}_2\text{Cr}_2\text{O}_7$, CuSO_4 , ZnSO_4 , As_2O_3 , $\text{K}(\text{SbO})\text{C}_4\text{H}_4\text{O}_6$, KCN, BaCl_2 , P, veratrine, cocaine-HCl, novocaine, cresol, Na salicylate, picric acid, resorcinol, chloral hydrate.

W. J. H.

The sugar-albumin condensation. S. P. L. SÖRENSEN AND L. LÖRBER. *Ber.* 60B, 999-1006(1927).—S. and L. criticize the results of Pringsheim and Winter (cf. following abstr.) at length and offer extensive experimental evidence to show that the analytical methods of P. and W. did not give correct results for the amt. of sugar albumin condensation taking place.

C. D. INGERSOLL

The sugar-protein condensation. HANS PRINGSHEIM AND MARGOT WINTER. *Ber.* 60B, 278-84(1927).—Glucose, added to NaCl soln. or lime water, contg. various proteins, or digestion products of proteins, also in soln., was no longer detectable quant. by Fehling's titration. A condensation product, of which glucose comprised 3 to 4% of the total wt., is postulated. The condensed glucose was still fermentable with yeast. Neither gelatin nor amino acids formed such condensation products. Fructose, galactose, maltose and lactose were able to replace glucose. About twice as much disaccharide condensed as monosaccharide, indicating a stoichiometric relationship. When the condensate was pptd. with $(\text{NH}_4)_2\text{SO}_4$ there was no titratable glucose in the protein-free filtrate. When HCl and heat were used to ppt. the compd., the glucose appeared in titratable form; it also appeared after HCl hydrolysis of the condensate. A blank expt. with protein and Cu_2O showed that the latter could be titrated. Perhaps the titratable glucose of the blood represents only a small part of the total glucose, most of which is condensed with protein.

G. E. SIMPSON

Amino derivatives of sugars. II. H. v. EULER AND EDV. BRUNIUS. *Ber.* 60B, 992-7(1927); cf. C. A. 20, 3286.—The reactions of Witte peptone, blood serum and serum albumin with glucose and fructose are investigated from the point of view of the effect of the nature of the amino compd. and of the sugar on the condensation that takes place. The results are reported on the basis of the decrease in the no. of mols. as evidenced by the difference in lowering of the f. p. between a soln. contg. both sugar and amino components and the sum of the f. p. lowerings of solns. of the individual

components. The reaction of peptone with fructose proceeds more rapidly than with glucose; a small reaction is evidenced between blood serum and fructose but none when glucose is used; a small reaction between fructose and serum albumin is noted. All of these condensations tend toward a condition of equil. Addendum. *Ibid* 997-9.—The condensation of amino bodies and sugars cannot be correctly detd. by the method of Bertrand due to the increased soly. of CuO in the presence of albumins or like amino compds. Polarimetric measurements are also inconclusive. This is in criticism of the investigational method employed by Pringsheim and Winter (cf. preceding abstr.).

C. D. INGERSOLL

The determination of sugar in the presence of protein and the supposed condensation of carbohydrates and protein. C. NEUBERG AND E. SIMON. *Ber.* 60B, 817-24 (1927).—The authors disprove the contention of Pringsheim and Winter (cf. 2nd preceding abstr.) that sugars condense with proteins to form a stable compd., claiming that the latter were misled by the methods employed. Mixtures of sugars and proteins were separated by dialysis, by colloidal Fe hydroxide, and by alc. pptn., with no evidence of a stoichiometric union between them.

J. J. WILLAMAN

The enzymes in the digestive tract of the bee. JOACHIM EVENTUS. *Arch. Bienenkunde* 7, 229-44 (1926); *Ber. ges. Physiol. expil. Pharmacol.* 40, 363.—Diastase, glycogenase and invertin are contained in the salivary glands (I) and in the middle (II) and lower (III) intestine, protease in I and II, lipase and catalase in II and III, pepsin, trypsin and chymosin (perhaps also tyrosinase) in II. Inulase, cellulase, lactase and emulsin are absent. I, III and the honey stomach are acid; II is alk. The malpighian bodies contain no enzymes. The enzymes are secreted by I and II only, catalase also secreted by III.

MARY JACOBSEN

Relative hypotension of foreigners in China. C. L. TUNG. *Arch. Internal Med.* 40, 153-8 (1927).—The av. systolic pressure of 58 Americans in China was 109, the av. diastolic pressure 65, against 118 and 76 in America. The blood pressure of Americans detd. after 3 years sojourn in China was lowered in 64-72% cases.

M. J.

Animal poisons in chemistry. P. LATZER. *Boll. chim. farm.* 66, 353-9, 385-90 (1927).—Pure lecithin reacts with venoms very slowly. Lecithin CdCl₂ was used for the expts. Lecithin ZnCl₂ reacts in the same way but is more difficult to prep. When incubated with cobra or *Crotalus* venom at 50° a 1% soln. of egg lecithin. CdCl₂ seps. an oily layer of satd. and unsatd. fatty acids (I no. 44.21, original I no. 65.34), while the hemolytic power of the aq. soln. increases. The lysocithin thus formed is not materially changed when subjected to an even prolonged action of snake, viper or bee poison. Pancreas lecithin behaves similarly, but the I no. of the sepd. fatty acids is only 11.74 in accordance with its compn. Of all venoms, wasp poison alone causes complete decompn. of egg lysocithin to fatty acids (I no. 58.55), choline, glycerol, H₃PO₄ and CdCl₂. Lysocithin made from Belfanti's γ substance behaves in the same manner. The I no. of the fatty acids is 31.7. If, however, the purified lysocithin of Delezenne or Fourneau is applied the I no. is zero. It follows that the venom of ophides has no selective saponifying action on glycerides of unsatd. fatty acids and that lysocithin does not necessarily contain satd. acids only. Egg lecithin CdCl₂ is completely hydrolyzed by wasp poison. The hydrolysis apparently takes place over lysocithin, since a transient hemolytic effect of the aq. layer may be observed. None of the animal poisons examd. had any effect on neutral fat or even triacetin. Unlike the other poisons wasp poison hydrolyzes Ca glycerophosphate (the Poulenc brand as well as the com. products which are probably mixts. of the α and β forms), and Na glycerophosphate. Common phytin and the phytin of *Hevea brasiliensis* (quebracic pentaphosphate) are not attacked. Short heating to 80° destroys the hydrolytic power for lysocithin and glycerophosphates. This difference between the wasp and other hymenoptera is apparently attributable to the fact that wasp larvae are fed on insects and the poison serves not only for defense but also for a preliminary digestion of the food. Since animal poisons have apparently no selective action on glycerides of unsatd. fatty acids the question arises whether the selective hydrolysis is detd. by the α - β positions of the fatty acids. If this is the case then lysocithin could only form from α -glycerophosphates. The quant. conversion of lecithin into lysocithin would consequently preclude the presence of a larger proportion of β -glycerophosphate in it. Grün and Limpacher's synthetic distearolecithin resisted the action of snake venom. Knowledge of the enzyme of snake poison is at the present limited to the fact that it is a phosphatidase, inducing a bimolecular reaction. Snake poison is remarkably stable. A sample of *Crotalus* venom kept in the dark since 1883 has preserved its full activity. The solns. of venoms used in the above expts. were inactivated only by ultra-violet rays.

MARY JACOBSEN

The enzymes of human skin. M. MELCZER. *Dermatol. Z.* 49, 252-61(1926); *Ber. ges. Physiol. expl. Pharmakol.* 40, 286; cf. C. A. 21, 1485.—All strata of skin completely freed from blood contain diastase, phenolase, catalase, peroxidase and glycolytic enzyme. The lipase, which is produced mainly by the epidermis, not by the sebaceous glands, is quinine- and atoxyl-fast, but the rate of lipolysis is lowered in the presence of these poisons. In severe pulmonary and peritoneal tuberculosis the skin lipase may be entirely absent.

Iodine content of thyroid in various animals. T. NOSAKA. *Folia endocrinol. japon.* 2, 878-933(1926); *Ber. ges. Physiol. expl. Pharmakol.* 40, 562.—The thyroid has the highest relative weight in man, the lowest in cattle and horses. In chickens and monkeys it has the highest, in horses, cattle, cats, rabbits and guinea pigs the lowest abs. I content. The I content/kg. shows the highest value in the chicken, the lowest in the monkey, horse, cattle, dog, cat, rabbit, guinea pig and snake.

The glucosides of *Fatsia japonica* DCne. et Planc. I. *Fatsia* sapotoxin. KENICHIRO OHTA. *Kitasato Arch. Expl. Med.* 7, 301-13(1926); *Ber. ges. Physiol. expl. Pharmakol.* 40, 348.—*Fatsia* sapotoxin, $C_{27}H_{42}O_{10}$, a white, amorphous, tasteless, hygroscopic powder was obtained by extg. the air-dried comminuted leaves with warm alc., purifying the ext. with Pb acetate and treating the alc. residue with 98% MeOH. Unlike the other saponins from which it also differs by its formula the sapotoxin froths only on addn. of a little alkali or alc. An attempt at the prepn. of a cryst. cholesteride was unsuccessful. Heating with 1% H_2SO_4 in 50% alc. yielded a clear yellow soln. and an insol. *sapogenin* I, $C_{22}H_{34}O_4$. **II. *Fatsin*.** *Ibid* 315-24.—*Fatsin*, $C_{31}H_{54}O_{20}$, a white, hygroscopic amorphous powder, easily sol. to a bitter soln., was prepd. by the alc.-ether method of Buchholz and by Greene's MgO method. Heating with excess 2% H_2SO_4 effects hydrolysis to insol. *sapogenins*, sugar and a volatile org. acid. The crude *sapogenin* consists of an ether-sol. α -*sapogenin*, $C_{18}H_{30}O_8$, and the ether-insol. β - $C_{10}H_{18}O_6$. **III. Biological study of *Fatsia* sapotoxin and *fatsin*.** *Ibid* 325-39.—The hemolytic effect of *Fatsia* sapotoxin by far exceeds that of all saponins known (tables of Schulz and Heyl), while that of *fatsin* is only slight. Cholesterol delays the hemolysis. Neither glucoside splits sugar off under the action of Takadiastase. *Fatsin* solns. became turbid on standing and acquired a fatty acid odor.

Atropine excretion in cow and goat milk. A. NAVRÁTIL. *Klinické spisy vys. školy zverolekarské Brno* 4, 75-94(1926); *Ber. ges. Physiol. expl. Pharmakol.* 40, 459.—The subcutaneous injection of 0.1 g. (I) atropine H_2SO_4 produced a violent reaction in a cow, while 0.05 g. (II) had hardly any effect. Milk I revived the frog heart in muscarine standstill in a diln. of 1:30, II in a diln. of 1:20. Since the atropine applied was effective in a concn. of $1:14^{-6}$ milk I must have contained 0.0021, II 0.0015 g. per l.

New method of activation. Preliminary report. OTTOKAR SCHULTZ. *Milch-wirtschaftl. Forschung* 4, 37-40(1927); *Ber. ges. Physiol. expl. Pharmakol.* 40, 479.—The deterioration of taste produced by ultra-violet irradiation of milk is caused by the action of H_2O_2 on the proteins and does not run parallel with the activation. The taste of protein-free cream or animal oils is not affected by prolonged irradiation.

The viscosity of protoplasm. L. V. HEILBRUNN. *Quart. Rev. Biol.* 2, 230-48 (1927).—A review with 64 references.

The electric capacity of animal tissues under normal and pathological conditions. G. W. CRILE, AMY F. ROWLAND and G. H. CRILE. *Am. J. Physiol.* 76, 320-4(1926).—The elec. capacity of each tissue appeared to be a characteristic const. but was subject to change under varying conditions, e. g., the injection of HCl, adrenaline, ether or $NaHCO_3$ caused more or less change in the elec. capacity of the liver, cerebrum, cerebellum and medulla oblongata.

Carbohydrate tolerance and its relation to the endo- and exogenic hyperglucemia curves. ALEXANDER OSZACKI. *Acta med. scand.* 66, 311-36(1927). S. MORGULIS

The effect of monoses and of magnesium ions on the formation of sugar from formaldehyde. HANS SCHMALPUSZ. *Biochem. Z.* 185, 70-85(1927).—In the process of condensation of HCHO under pressure in the presence of MgO there appear MeOH, HCOOH, triose, pentose and hexose; also diacetyl and furfural are found, but no glycol- or glycerol-aldehyde. The triose was identified as dihydroxyacetone. In the condensation of a 2% HCHO soln. 1.33% glucose appears on the av. Evidently, an equil. is produced soon between HCHO, triose, pentose and hexose, but this is upset by further production of these substances. The same reducing substances are formed at 100° and 120° and 2 atm. of pressure. At 95° there is no condensation, the rate of which increases with the rising temp. The rate of condensation increases with the

MgO concn., but not beyond the amt. necessary to neutralize the inhibiting acids produced. The condensation in the presence of $\text{Ca}(\text{OH})_2$ or NaOH proceeds more rapidly but the sugar also undergoes rapid destruction. $\text{Al}(\text{OH})_3$ is too weak an alkali to promote the condensation. MeOH does not influence the condensation; Mg formate enhances it greatly, which can also be accomplished with equiv. amts. of $\text{Mg}(\text{OAc})_2$ or MgCl_2 . On the contrary, Na, K or Ca formate does not affect the rate of condensation; and Cu formate actually inhibits it very much. Therefore, in Mg formate it must be the Mg ion which has the stimulating effect. Acids inhibit the condensation, this effect being greatly increased by the addn. of furfural. Sugar affects the condensation rate so strongly that often the condensation is completed before the necessary temp. has been attained.

S. MORGULIS

The solubility of uric acid in carbonate salts and the effect upon it of carbonic acid. S. LANG AND H. LANG. *Biochem. Z.* 185, 88-112(1927).—The soly. of uric acid in bicarbonate solns is not parallel to the bicarbonate content, but corresponds to an exponential function provided the liberated CO_2 cannot escape. The same also holds true with some modification for the soly. in carbonate solns. In low salt concns. there is complete salt formation but in high concns. (above $N/30$) there is a direct but not complete proportionality of the uric acid salt formation. Absorption of small amts. of CO_2 inhibits the formation of the uric acid salt.

S. MORGULIS

Preparation of sepia melanin from sepia melanic acid. OSKAR ADLER. *Biochem. Z.* 185, 169-72(1927).—Twenty g. of dried sepia ink is extd. with a 15% alc. in benzene. The ext. is washed with alc. and ether, and after drying off the ether, the mass is boiled first with H_2O then with 5% HCl ; it is washed Cl -free with boiling water, and finally with alc. and ether. The material is carefully fused with KOH for 30 min., dissolved in H_2O , and the soln. is decanted through a filter. The sepia melanic acid is pptd. from the filtrate on adding HCl . The substance contains 2.66% H, 1.08% S and 8.62% N.

S. MORGULIS

Studies on the influence of arsenic and antimony compounds on the enzymic functions of the organism. IV. The cause of the inhibitory action of tartar emetic on salivary amylase. I. A. SMORODINTZEV AND E. A. ILIIN. *Biochem. Z.* 185, 328-33(1927).—The inhibitory effect of tartar emetic is due to the acid reaction of its solns. which displaces the p_{H} of the digestion mixt. from the opt. In a properly buffered medium tartar emetic neither accelerates nor retards the amylase activity of saliva.

S. MORGULIS

Proteolytic enzymes of serum. VIII. Investigations on the possibility of a fundamental unit of blood enzyme. M. VON FALKENHAUSEN. *Biochem. Z.* 185, 334-43(1927); cf. *C. A.* 21, 2308.—The "fundamental enzyme" is prepd. according to Galwialo from a 1:10 or 1:15 dil. cold oxalated plasma, through which CO_2 is passed for 10 min. A ppt. settles out on standing for 24 hrs. The ppt. is ground with sand and extd. with ice cold water, and filtered. The filtrate is supposed to show diastatic, proteolytic or lipolytic action upon the addn. of the electrolytes of saliva, gastric or pancreatic juice. It is thought that Galwialo's soln. is really an isolated mixt. of the known blood enzymes.

S. MORGULIS

The possibility of changing one enzymic property into another depending upon the experimental conditions. M. J. GRAMENITZKI. *Biochem. Z.* 185, 433-7(1927).—From the fact that the blueing of a tincture of guaiac by blood in the presence of H_2O_2 depends upon proper quant. relationships between the blood and H_2O_2 , disappearing when the blood is in excess in the system, it is attempted to develop the view that the peroxidase or catalase reactions of the blood are simply different manifestations of the same fundamental property of the blood regulated by mass action.

S. MORGULIS

The enzymes of the skin. VIII. Lactic acid formation in the skin and the effect of various lights on it. J. WOHLGEMUTH AND TOSHISUKE IKEBATA. *Biochem. Z.* 186, 43-53(1927); cf. *C. A.* 21, 457.—The skin from cadavers can produce lactic acid with or without the addn. of carbohydrate, but the fresh human skin has a much greater ability for lactic acid production. The skin from severe diabetics forms lactic acid as well as that from normal individuals. Insulin does not affect the lactic acid production of fresh skin, but it does increase the production by the dead skin or diabetic skin. Natural sunlight injures somewhat the ability of the skin to produce lactic acid, while artificial sunlight (ultra-violet) is more injurious and x-rays are the most injurious. Levulose is the best source of lactic acid.

S. MORGULIS

The arginine content of some proteins and of both normal and amyloid organs. OTTO FÜRTH AND OTTO DEUTSCHBERGER. *Biochem. Z.* 186, 139-54(1927).—Kossel and Gross' method for detg. the arginine in pure proteins which depends upon the formation of an insol. cryst. compd. with flavianic acid is not applicable to hydrolysates

obtained from various organs because of the presence of interfering substances. The procedure was therefore modified in that the basic N in the hydrolysate is detd. by pptn. with phosphotungstic acid. The ppt. is then decompd. and the fraction of basic N pptd. by flavianic acid is detd. The proportion of arginine N to the total base N is thus measured and by calculation the arginine content of the original organ is

cent. 10/100. The arginine content of human and animal organs was 6.5–8.1% for the kidney, liver and spleen. There was no difference in the arginine content of normal organs and organs with amyloid degeneration. S. MORGULIS

The absorption of porphyrins in the region of the ultra-violet spectrum. W. HAUSMANN AND O. KRUMPEL. *Biochem. Z.* **186**, 203–12(1927).—Hematoporphyrin-HCl in alk. or acid soln., the tetramethyl esters of hematoporphyrin, octamethyl ester of uroporphyrin and tetramethyl coproporphyrin were studied in CHCl_3 soln. Uroporphyrin and coproporphyrin show absorption in the range of $\lambda = 300\text{--}400\mu$, which may account for their sensitizing action in the ultra-violet light. S. MORGULIS

The effect of different carbohydrate-phosphoric acid esters on the fermentation of glucose. PAUL MAYER. *Biochem. Z.* **186**, 313–6(1927).—Expts. with various natural and synthetic glucose-mono-phosphoric esters show that they all possess the ability to accelerate the beginning of fermentation. S. MORGULIS

Keto-aldehyde mutase in wheat, rye and soy bean seeds. LUDWIG KLAR. *Biochem. Z.* **186**, 327–30(1927).—Phenylglyoxal hydrate is quant. converted to optically active mandelic acid by wheat, rye or soy-bean meal. S. MORGULIS

Fermentation of glucose and pyruvic acid. A. LEBEDEV. *Biochem. Z.* **186**, 376–7(1927). S. MORGULIS

Studies on the composition of the cell membrane by a new method of determining surface tension. STUART MUDD AND EMILY B. H. MUDD. *Biochem. Z.* **186**, 378–90(1927). The method consists in studying the degree to which the cell surface is wetted when the cells are distributed in the interface between 2 liquids. By proper choice of liquids and other exptl. conditions important information is derived regarding the nature of the surface layer. Red blood cells, leucocytes, blood platelets, bacteria and spermatozoa have thus been investigated. S. MORGULIS

Studies on protein coagulation in drops. IX. Synergism of mixtures of protein. F. BEHM. *Biochem. Z.* **187**, 84–91(1927).—Studies made on mixtures of albumin and globulin show that the type of coagulation is detd. by the globulin, while the pptn. value of the mixt. is the arithmetical mean of the values for each component. The av. pptn. value for various globulins varies in the order: edestin > egg globulin > serum globulin; similarly with albumins, serum albumin > egg albumin. But the av. pptn. values for serum and egg protein are practically the same (25:24). S. M.

Studies on the catalase content of blood of mid-Asiatic mountaineers. A. I. ALEXEEV. *Biochem. Z.* **187**, 92–7(1927).—The catalase activity of the blood of mountaineers diminishes markedly toward evening. The catalase activity as well as the no. of red cells and the hemoglobin index are greater than in normal individuals. The coeff. of correlation between catalase activity and viscosity of the blood is 0.87. The coeff. of correlation between catalase activity and the no. of red cells is 0.9 in the morning and only 0.72 in the evening. The catalase index (catalase activity/no. of red cells) = 3.75. Similar relationships exist between the hemoglobin index and catalase activity. S. MORGULIS

The fermentation of α -ketobutyric acid and oxalacetic acid. VII. The dependence of the alcohol fermentation on hydrogen ion concentration. ERIK HÄGGLUND AND ANDERS RINGBOM. *Biochem. Z.* **187**, 117–9(1927).—Studies on the relative velocity of fermentation of oxalacetic and α -ketobutyric acids at different p_H values show that the carboxylase is fully active only within a definite p_H range, which varies with the nature of the substrate. S. MORGULIS

The nature of the pyruvic acid fermentation. CARL NEUBERG AND ERNST SIMON. *Biochem. Z.* **187**, 220–53(1927).—An extensive discussion of the role of pyruvic acid in the process of fermentation. S. MORGULIS

The effect of illumination on tyrosine and tryptophan in the protein compound. FRITZ LIEBEN. *Biochem. Z.* **187**, 307–14(1927).—Tyrosine and tryptophan undergo oxidative decompn. in protein exposed to diffuse daylight or to the Hg lamp, but in the first instance the presence of a sensitizer is necessary. The destruction of these 2 amino acids in the protein mol. proceeds slower than when the free acids are submitted to the same treatment. The velocity is increased by alkyl. and with trypto-

phan, by formaldehyde. Even the minutest trace of H_2O_2 destroys the color reaction of Voisenet and Hopkins, but if the H_2O_2 is removed by spongy Pt the reaction reappears. The Millon reaction for free tyrosine is less easily affected and is obtained even when the H_2O_2 is definitely pos. S. MORGULIS

Sensitization of cholesterol hydrosols. RUDOLF STERN. *Biochem. Z.* **187**, 315-23 (1927).—The mutual relations between cholesterol, protein and H-ion concn. in the pptn. of cholesterol are discussed. S. MORGULIS

Photoactivity of cholesterol. JAN STŘEŠKÝ. *Biochem. Z.* **187**, 388-97 (1927).—Sunlight has the ability to photoactivate cholesterol to a certain extent. The effect produced by ultra-violet rays is much stronger, the photochem. effect depending upon the distance of the lamp and the exposure time. The photoactivity of the cholesterol, however, diminishes with time, disappearing entirely after 3 days. X-rays have a much weaker influence than ultra-violet rays. Expts. show that the presence of O_2 is necessary in order to produce the photoactivity of cholesterol. However, no trace of H_2O_2 could be detected in the reaction, but the Arnold test for ozone indicates the presence of the latter. It is concluded, therefore, that the ozone is the direct product of the action of the rays on cholesterol in the presence of O_2 , and that the process involves a more profound alteration of the structure of the cholesterol than a mere satn. of its double bonds. It was further found that higher temps. tend to increase the influence of radiation on cholesterol. In fact, very high temps., such as that of the m. p. of cholesterol, themselves induce photoactivity, which must thus be regarded as a manifestation of the oxidation of cholesterol. S. MORGULIS

Electrodialysis of proteins. WOLFGANG PAULI. *Biochem. Z.* **187**, 403-9 (1927). S. MORGULIS

Cadaver wax. S. GOY. *Biochem. Z.* **187**, 470-1 (1927).—The most striking change between cadaver fat and cadaver wax is the extraordinary increase in amt. of free fatty acids. The other fact worthy of note is the diminution of the iodine number indicating an increase in the satd. acids. Likewise, the Reichert-Meissl number changes from the low value (1.3) in the fresh fat to a value nearly $1/2$ that of butter (=13). S. MORGULIS

The enzymic transformation of hexosediphosphate into hexosemonophosphoric acid ester and the enzymic synthesis of hexosediphosphate from hexosemonophosphate. C. NEUBERG AND J. LEIBOWITZ. *Biochem. Z.* **187**, 481-90 (1927). S. MORGULIS

Effect of light on the process of decoloration in a dehydrogenase methylene blue system. A. KRESTOWNIKOFF. *Skand. Arch. Physiol.* **52**, 199-208 (1927).—Even moderate illumination causes an increased rate of decoloration in a dehydrogenase (H-donor)-methylene blue system. A pure water soln. of methylene blue or a soln. in phosphate of the same p_H as the enzyme mixt. is not affected in such a way by the light. S. MORGULIS

The electrostatic charge of cells of human blood, a contribution to the question of acidophiles and basophiles. HELMUT MOMMSEN. *Folia Hematol.* **34**, 50-64 (1927).—The H-ion concn. is important in blood stains. All parts of a cell stain with an acid stain in an acid medium, and with an alk. stain in an alk. medium. The conception of acidophile and basophiles has no abs. significance. The change in staining reaction occurs at the isoelec. point. The isoelec. point can be detd. by staining in a series of buffered stains. At a p_F of 5.3, normal neutrophilic granules will not stain, but in many acute infections they will. JOHN T. MYERS

Proteolytic activity of pancreatic extracts. I. A. SMORODINTZEV AND A. N. ADOVA. *Russ. acad. sci. union rep. soviet. social.* **20**, 1491-1502 (1926).—The natural pancreatic juice of a dog obtained by I. P. Pavlov's method is $1\frac{1}{2}$ -2 times as powerful as the most active tryptic preps. The proteolytic activity of the latter is weakened by various treatments to which pancreatic exts. are subjected according to A. Danilevskii's method modified by S. Fränkel and by Wittich's method. Wittich's prepn. is 10 times as active as Danilevskii's prepn. and yields more trypsin. The treatment of the aq. pancreatic ext. with phosphoric acid and with milk of lime reduces its proteolytic activity almost to a half of its former value. Ca phosphate partly adsorbs the protease of pancreatic exts. Prolonged evapn. of exts. *in vacuo* is accompanied by a reduction of proteolytic activity up to $1/7$ of its original value. On filtering the aq. glycerol ext. of the tissue through paper the residue remaining on the filter possesses a considerable digestive capacity. Filtration of the glycerol pancreatic ext. through paper followed by pptn. with alc. yields ppts. easily sol. in alkalies and possessing a high proteolytic activity, whereas the liquid remaining after the alc. pptn. possesses no proteolytic value. BERNARD NELSON

Study of an amylase of bacterial origin. WANAUVERBECQ. *Bull. assocn. élèves inst.*

sup. fermentations Gand 28, 300-14(1927).—Effront's "achrodeextrinase" (C. A. 11, 1841) is shown to produce notable amts. of glucose and of an unidentified unfermentable sugar, probably isomaltose, in the saccharification of starch. Its action is almost unaffected by variations in temp. from 35° to 75°, and by variations in p_H from 4 to 8.

A. PAPINEAU-COUTURE

Some recent work on amyloid. S. DOUBROW. *Bull. histol.* 3, 1(1926); *Colloides biol. clin. therap.* 1, 81(1927).—A crit. review.

A. PAPINEAU-COUTURE

Chemical conception of acid de-albuminization. P. CRISTOL. *Bull. soc. sci. méd. biol.* March, 1926; *Colloides biol. clin. therap.* 1, 40(1927).—Instead of considering the pptn. of proteins as a purely phys. phenomenon due to the lowering of the p_H below the isoelec. pt., the pptg. action of certain acids towards proteins may be explained by the usual laws of chemistry. An acid de-albuminizing agent may therefore be defined as one which, at an acidity above the isoelec. pt., reacts with proteins to form insol. protein salts.

A. PAPINEAU-COUTURE

Modifications of the colloidal state of the plasma by certain fluorescent dyes. PIERRE GIRARD. *Colloides biol. clin. therap.* 1, 47-50(1927).—See C. A. 20, 3506; 21, 2318.

A. PAPINEAU-COUTURE

The influence of salts upon the ionization of egg albumin. S. P. L. SPØRENSEN, K. LINDERSTRØM-LANG AND E. LUND. *J. Gen. Physiol.* 8, 543-99(1927).—The principle followed in the exptl. detn. of the ionization of egg albumin, its capacity to combine with acids and bases, is described. Egg albumin⁹ is regarded as an ampholyte which combines with acids and bases according to the following theoretical equation: $B_H = Y - a_H/f_H + C_{BHS}.k_B f_{BH}^+/f_B a_H$, when B is a weak base, B_H = equivs. of H ion taken up or given off by egg albumin, Y = equivalents of acid or base, positive in the first case, negative in the latter, a_H = the activity of the H ion (cf. Lewis and Randall, Thermodynamics and the Free Energy of Chemical Substances, N. Y. and London, 1923), f_H , f_B , f_{BH}^+ , the activity coeffs., resp., of the H ion, uncharged base and positive ion, C_{BHS} , the concn. of salt. Where B is not a weak base, k_B can be taken = 0, and the equation becomes: $\beta_H = Y - a_H/f_H$. f_{BH}^+ , f_B and k_B values were detd. for NH_4Cl solns. and for solns. of NH_4Cl and NH_4OH . The capacity of egg albumin to combine with acids and bases was studied in solns. of $NH_4Cl + HCl$, $KCl + HCl$ and $(NH_4)_2SO_4 + H_2SO_4$. A distinction between the isoelectric and isoionic reaction of an ampholyte is suggested. The isoelec. reaction is defined as the H-ion activity (pa_H) at which the mean valency of the ampholyte is 0. The isoionic reaction is the H-ion activity at which the quantity of acid or base combined with the ampholyte is 0. If the ampholyte does not combine with ions other than the H ion, the isoelec. and isoionic reactions coincide. The effect of salt on the ionization of egg albumin consists in a turning of the ionization curves, indicating the relation between the quantity of combined acid (isoionic reaction) and pa_H . The turning of the curves, which leaves the isoelec. reaction unaltered, tends in such a direction that the quantity of combined acid at const. ampholyte concn. and const. pa_H increases with increasing salt concn. The quantity of combined Cl ions is insignificant in comparison with the combined H ions except in the vicinity of the isoionic reaction. The isoionic reaction is independent of the NH_4Cl concns. On the basis of the theoretical considerations given ionization curves can be calcd. which are in approx. quant. agreement with exptl. results.

C. H. R.

A propos glucrofranguline. P. CASPARIS AND R. MAEDER. *Bull. soc. chim. biol.* 9, 324-6(1927).—A reply to M. Bridel and C. Charaux (C. A. 21, 937).

L. W. RIGGS

Biologic similitude and law of surfaces. GEORGES TESSIER. *Compt. rend. soc. biol.* 97, 206-7(1927).

L. W. RIGGS

Post-mortem variations of the p_H of the tissues. P. REISS AND C. SIMONIN. *Compt. rend. soc. biol.* 97, 306-8(1927).—By potentiometric measurement it was found that after death the variations of p_H of the tissues generally pass through 2 phases: that of increased acidification of intrinsic origin, followed by a phase of alkalization from putrefactive causes.

L. W. RIGGS

Active substance of the Bareges waters. RENÉ ROBINE AND M. DEJUSSIEU. *Compt. rend. soc. biol.* 97, 313-6(1927).—The active substance, *baregin*, of the Bareges springs is a viscous unctuous material, the product of certain algae in the thermal S waters. Analysis of dry baregin by Filhol (1865) showed N 3.5%, ash 49%. The ash was made up of $CaCO_3$ 28%, SiO_2 16.2, FeO 4, $NaCl$ 0.6, $Ca_3(PO_4)_2$ 0.2, sum 49. Later analyses have shown the presence of As, Al, Cu, Mn and of larger percentages of chlorides, sulfates and phosphates. Thirteen different microbic organisms were isolated from baregin, which is considered a waste product formed by the hydrated cadavers of the microbic organisms.

L. W. RIGGS

Apropos the mechanism of the passage of various substances from the blood into the cerebrospinal fluid. L. STERN AND J. RAPOPORT. *Compt. rend. soc. biol.* 97, 366-8(1927).—A general discussion. L. W. RIGGS

Effect of certain substances on anticalalasic action. E. M. RIAKHINA AND S. R. ZUBKOWA. *Compt. rend. soc. biol.* 97, 479-80(1927).—The solns. of catalase used were such that 1 cc. would decomp. 4 g. of H_2O_2 in 5 min. at ordinary temp. The anticalalase was obtained from aq. exts. of the spleen treated with HCl in the proportion of 2 cc. of acid (d. 1.19) to 1 l. of ext. Acidity should not exceed a p_H of 5.2. The anticalalase was added to the soln. of catalase in the proportion of 1 to 2, the anticalalase having been brought previously to a p_H 6.25. The anticalalasic power is measured by detg. the diminution of catalase in the mixt. after standing 20 min. in the thermostat at 38° . In the tests the anticalalase diminished the power of the catalase by $\frac{2}{3}$. The substances studied were added to the mixt. of catalase and anticalalase, and after standing 20 min. in the thermostat in the presence of O_2 , the catalytic power was measured with H_2O_2 . In this manner 10 alcs., 3 aldehydes, 4 sugars, 9 acids, 3 amino acids, acetone and urea were tested. All of the alcs., except EtOH and $C_2H_5(OH)_2$, completely prevent the anticalalytic action. HCHO and CH_3CHO totally prevent both catalytic and anticalalytic actions. C_6H_5CHO and Me_2CO were incomplete in their action. The sugars and acids except HCOOH were without action. L. W. RIGGS

The system catalase-anticalalase in the blood and various organs of animals in different physiologic and pathologic conditions. E. D. GAGARINA AND W. D. JANKOWSKY. *Compt. rend. soc. biol.* 97, 481-2(1927).—Expts by the method of Battelli and Stern were made with rabbits, guinea pigs and rats. In animals poisoned by a subcutaneous injection of morphine there was an increase of catalase in all of the tissues but especially in the liver and muscles. At the same time the catalase was much diminished in the blood. The anticalalase was diminished in all tissues except muscle and lung, where it was slightly increased. Animals poisoned by a subcutaneous injection of As showed an increase of catalase and anticalalase in the liver and muscles and a diminution in the blood. Animals poisoned by alc. gave a diminution of catalase and anticalalase in the liver and blood, but a slight increase in the other organs. L. W. RIGGS

Calcium carbonate and calcium bicarbonate. Hydrogen-ion concentration of saturated solutions in water. J. W. WILLIAMS AND J. A. CHUCKA. *J. Am. Med. Assoc.* 89, 445-6(1927).—The p_H value at 25° of satd. $CaCO_3$ suspensions by potentiometric methods with H electrode ranged from 8.64 to 8.86, av. 8.78. $Ca(HCO_3)_2$ was prepd by passing CO_2 through the $CaCO_3$ suspension until equil. was reached. The p_H value of $Ca(HCO_3)_2$ soln. detd. with the quinhydrone electrode gave 5.98 when CO_2 was passing through the soln., and 6.19 without excess of CO_2 . Suspensions of $CaCO_3$ taken internally would seldom if ever produce alky. of the gastric juice. L. W. RIGGS

Further studies on the antirachitic activation of substances by cathode rays. ARTHUR KNUDSON. *Science* 66, 176-8(1927).—Com. cholesterol exposed to cathode rays for 30 sec. is effective in curing rickets in doses of 1 to 2 mg. per day in rats. Cholesterol purified by the dibromide method is not rendered antirachitic by either cathode or ultra-violet radiation. Yeast, starch and cottonseed oil can also be activated by exposure to cathode rays. Yeast previously extd. in a continuous type of Soxhlet app. for one week with Et_2O was still rendered strongly antirachitic by cathode rays. L. W. RIGGS

Limitations of Warburg's theory of the role of iron in respiration. J. WILLIAM BUCHANAN. *Science* 66, 238-9(1927).—Warburg's theory of cellular oxidations is criticized as inadequate to explain many of the facts that are assocd. with changes in the rate of oxidations in the living organism. L. W. RIGGS

Enzymic mutation of xanthine and hypoxanthine without the participation of an external hydrogen acceptor. A. BACH AND D. MICHLIN. *Ber.* 60B, 82-6(1927).—By the action of purified milk enzyme (for prep. see C. A. 19, 3277) under an atm. of N, in a NaOH- KH_2PO_4 soln. of $p_H = 7.8$, uric acid was obtained from xanthine or hypoxanthine. For a similar effect with salicylaldehyde as the substrate cf. C. A. 20, 3302. Thus the O_2 absorption, which Hopkins and his pupils have found to accompany the action of the Schardinger enzyme on these purines, has no direct relation to the oxidation. Reasons are presented for preferring the name perhydridase for the Schardinger enzyme, to the name aldehyde-dehydrase, which Oppenheimer (C. A. 20, 3468) gives it. GEORGE ERIC SIMPSON

Protein storage in protoplasmic tissue. A. G. HOGAN, W. S. RITCHIE AND J. E. HUNTER. Missouri Agr. Expt. Sta., *Bull.* 236, 27 pp.(1926).—A progress report in

which data are given on the amt. of globulin pptd. from soln. by various methods. The results obtained by electro dialysis corresponded closely with those obtained by satn. with Li sulfate and half satn. with $(\text{NH}_4)_2\text{SO}_4$. J. J. SKINNER

The activities of a constructed colloidal cell. D. T. MACDOUGAL and VLADIMIR MORAVEK. *Protoplasma* 2, 161-88 (1927).—By a new method it has been found possible to dissolve cholesterol in lecithin and incorporate the mixt. in hydratable gels. The cholesterol is first dissolved in Et_2O , passes into soln. in lecithin, after which the Et_2O is evapd., giving a lecithin-cholesterol solp. and also cholesterol particles with a protective layer of lecithin. Constructed cells with lecithin-cholesterol incorporated in the gelatin and agar display differential action in endosmosis, permeability and p_H strikingly similar to those of living cells. Constructed cells with lecithin-cholesterol constituting 1 part in 1000 of the material of the layers and with contents of 20% sugar soln. showed an increasing endosmotic series in $\text{Na}|\text{K}|\text{Ca}$, implying a decreasing series in permeability under the influence of these cations in the presence of Cl. The addn. of Ca to Na or to K in immersion solns. lessens permeability and results in greater endosmosis than in Na or K alone. The inclusion of lecithin-cholesterol in the walls of constructed cells lessens the rate of penetration of Cl. One max. of rate of penetration of Cl is from immersion solns. at p_H 4.5 and a second at 5.4. Permeability of a complete cell including lecithin-cholesterol was greatest at p_H 2.9 of the immersion liquid, lessens toward p_H 4.65, and changes but slowly with variations in p_H until neutrality is passed, when it rises to a second lesser max. at p_H 7.25. The omission of lecithin-cholesterol from the layers of constructed cells causes permeability to decrease as the acidity is reduced in the immersion liquid to p_H 5.4, then an increase to 6.5, a decrease to 7.3 and a rise as alk. becomes greater. The zones of lesser permeability would be a resultant of the least hydration capacities of gelatin and agar included in the layers. Colloidal cells with lecithin-cholesterol in the layers showed no variation in the p_H of the contents, 20% sugar soln. greater than 0.25, although the immersion soln. might vary between p_H 3.05 and 8.2. Endosmosis, penetration of Cl and K ions and outward diffusion of sugar, did not affect the acidity of the contents. This stabilization is similar to that of the living cell and is seen to depend upon the presence of lecithin-cholesterol in the walls. Stabilization of the p_H of the contents of colloidal cells is due to the fact that the cholesterol component is satd. as to OH and repels them, while adsorbing H and facilitating its penetration. Lecithin on the other hand adsorbs and holds OH and retards the penetration of H ions. Auxographic measurements of sections of the layers of constructed cells, which already hold about 90% of their total water of hydration, form the increasing series $\text{Ca}|\text{Na}|\text{K}$. Interferences between Na and Ca resulted in swellings of the layers of the complete cell greater than those in Na alone, but no greater than the changes in Ca alone. M. H. SOULE

The optical behavior of protein solutions. C. V. RAMAN. *Nature* 120, 158 (1927).—Around the isoelec. point of gelatin its Tyndall effect increases considerably (cf. Kraemer, *C. A.* 21, 2210). On applying to this phenomenon the thermodynamic theory of light scattering as a function of osmotic pressure P of the particles (Tyndall effect considered as due to local fluctuations in optical d.) in the equation for scattering power $= (\pi^2 RT/2 N \lambda^4) [k(\partial\epsilon/\partial k)^2(\rho/m)/(\partial P/\partial k)]$ (k is concn., ϵ optical dielec. const., ρ/m is practically one for dil. solns.) the Tyndall effect becomes related to P changes around the isoelec. point. B. J. C. VAN DER HORVEN

Establishment of the optimal hydrogen-ion activities for the enzymic hydrolysis of starch by pancreatic and malt amylases under varied conditions of time and temperature. H. C. SHERMAN, M. L. CALDWELL AND MILDRED ADAMS. *J. Am. Chem. Soc.* 49, 2000-5 (1927).—As the temp. of hydrolysis is increased from 30° to 70°, malt amylase exerts its optimal activity at different H-ion activities when acting in the presence of 0.06 M phosphate mixts.; whereas in the presence of 0.01 M acetate-AcOH mixts., this amylase exerts its optimal activity in solns. of the same H-ion activity at the different temps. In the presence of 0.06 M phosphate, the H-ion activities of the solns. affording optimal activity of the enzyme did not show appreciable change as the exptl. period was lengthened from 0.5 to 2 hrs. at any given temp. (30-60°) while in the presence of 0.01 M acetate there is a tendency for the enzyme to exert its optimal activity in slightly less acid solns. as the period of hydrolysis is increased. This difference in behavior is not due to the influence of heat or of the products of hydrolysis upon the H-ion activities of the solns. themselves. Whether in the presence of phosphate or acetate, a higher temp. seems to render malt amylase more sensitive to changes in the H-ion activity of its environment. Pancreatic amylase, in expts. of 0.5 to 2 hrs. at 30-50°, exerted its optimal activity at p_H 7.0-7.2; but in expts. at 60° the optimal activity for 0.5-hr. periods was found at p_H 6.9 and for 2-hr. periods at 6.7. The results

indicate that the factors which induce optimal enzymic activity are even more dependent upon each other than has previously been realized and that none of them should be regarded as fixed if any of the others is changed.

C. J. WEST

Enzyme studies. I. Stomach lipase and its optimum. KENSUKE GYOROKU. *Proc. Imp. Acad. (Japan)* 3, 242-4(1927). (In German.)—The optimum reaction of the stomach lipase of rabbit, dog and man is ordinarily at p_H 5.7-6.5; this is not changed by treatment with AcOH but after purification with kaolin it lies at 7.6-7.8. The p_H optimum of hog stomach lipase is ordinarily between 7 and 8; if the stomach powder is allowed to stand several weeks, it shifts to p_H 6.0-6.5 but this is not the case with other animals (rabbit, dog). However, if the rabbit or dog lipase, mixed with PhMe, is allowed to stand several days, the change to the alk side takes place. If the purified lipase is mixed with an impure lipase inactivated by heat, the mixt. shows the alk. max. (p_H 7.6-7.8). **II. Organ lipases and their stability toward acids and alkalies.** *Ibid* 245-6.—Stomach lipase is more resistant to acids than to alkalies, and has a greater stability toward chemicals than other organ lipases. The purified stomach lipase loses its great resistivity toward acids, and is not more resistant than pancreas lipase. Similarly, the pancreas and liver lipases lose their great stability toward alkalies when completely purified. Strong acids or alkalies exert greater injury upon lipases than weaker ones. Addn. of acid- or alkali-binding substances (proteins or peptone solns.) protects the lipase against this injury to a certain degree, although the abs. amt. of the acid or alkali remains unchanged.

C. J. WEST

Diffusion potential measurements applied to HCl-gelatin systems (FERGUSON, BACON) 2. Porphyrins. XIII. The chemism of porphyrin formation and the constitution of hemin (KÜSTER, SCHLAYER) 10. The so-called carbohydrate group in protein (FRANKEL, JELLINEK) 10.

MAYER, EDGAR: Clinical Application of Sunlight and Artificial Radiation. Baltimore: Williams & Wilkins. 468 pp. \$10.00. Reviewed in *Phys. Rev.* 30, 223(1927).

PARSONS, T. R.: Fundamentals of Biochemistry. 2nd ed. Baltimore, U. S. A.: The Williams & Wilkins Co. 295 pp. \$3.00.

VLÉS, FRED: Travaux pratiques de physique biologique. Paris, 1927: Vigot. 99 pp. Reviewed in *Bull. soc. hyg. aliment.* 15, 262(1927).

B—METHODS AND APPARATUS

STANLEY R. BENEDICT

A chemical test for sex. D. G. STEELE AND AGNES L. ZEIMET. *Am. J. Physiol.* 76, 230(1926).—The Manoilloff test was studied and shortened. The accuracy is about 70-80%. Details of the test are not given.

J. B. BROWN

The chemical mechanism of Golgi's black reaction. A. MOSCHINI. *Arch. farmacol. sper.* 43, 97-114(1927).—A discussion of the various theories that have been advanced to explain the mechanism of the Golgi reaction (sp. staining of nerve tissue when treated with $K_2Cr_2O_7$; followed by $AgNO_3$ or $HgCl_2$).

A. W. DOX

The use of aminophenols as reagents for uric acid and other substances of this group. E. PITTARELLI. *Arch. farmacol. sper.* 43, 142-4(1927).—An alk. soln. of uric acid or other purine when treated with $p-HOC_6H_4NH_2$ or $p-HOC_6H_4NHMe$ (metol) and $K_2S_2O_8$ gives a yellow color which appears in a few seconds and reaches its max. in 0.5 hr. In the absence of purine $p-HOC_6H_4NH_2$ gives a red color after several hrs., and metol an intense blue within a few min., the latter color changing to red on addn. of acid. The uric acid reaction is sensitive 1:100,000, and is claimed to be applicable to the colorimetric detn. of uric acid in urine. No other normal constituent of urine gives this reaction. The colored product is insol. in org. solvents in the presence of alkali, but in the presence of acid it dissolves in $AmOH$ and $AmOAc$.

A. W. DOX

The spectrophotometric determination of hemoglobin. G. E. DAVIS AND CHARLES SHEARD. *Arch. Internal Med.* 40, 226-36(1927).—The Dare, Sahli and Tallqvist methods are unreliable as shown by comparative literature data, while the evidence is divided for the Newcomer, Smith and Cohen methods. The spectrophotometric method is recommended as highly accurate, simple and fairly rapid. A simple and inexpensive spectrophotometer (Keuffel and Esser) with color filter and neutral density wedge is described.

MARY JACOBSEN

The apparent neutral reaction of certain ampules for hypodermic use and Sørensen's p_H . ARNALDO MAURI. *Quim. ind.* 4, 214-8(1927).—The presence of only 1% fluorite or other F compds. in the glass gives rise to acidity p_H 5, which is obviously caused by free HF, since the max. amt. of B_2O_3 employed never gives a p_H below 5.8-6.

and borosilicate alone is never acid. The official (autoclave) test is inadequate, since alkali is liberated, giving the false impression of neutrality. The following test is recommended: Shake the ampule with twice-distd. water and det. the p_H colorimetrically. If the result is satisfactory sterilize with twice-distd. water for 1 hr. at 135° and repeat the p_H detn.

Acidity of urine. G. TELLERA. *Boll. chim. farm.* **66**, 449-56(1927).—The colorimetric detn. with Guillaumin's methyl red-bromothymol blue indicator as recommended by Fleury (*C. A.* **19**, 2350) is satisfactory for approx. detns. within the range of p_H 4.6-7.

MARY JACOBSEN

MARY JACOBSEN

A densimeter for the rapid determination of the specific gravity of small quantities of liquids and solids. P. LECOMTE DU NOÛY. *J. Biol. Chem.* **74**, 443-8(1927).—An app. has been devised for the rapid detn. of the sp. gr. of 1 cc. of liquid to the 3rd decimal place and of solids and powders with an error not more than 5 units in the 4th place with 0.1 g. of substance. The principle adopted is exactly the same as that used in the author's tensiometer, namely, a torsion balance fitted with a dial and vernier. It is absolutely necessary to remove the air from powders and this preliminary technic is lengthy although the measurement takes only a few secs.

A. P. LOTHROP

A gasometric micro-method for the determination of iodates and sulfates, and its application to the estimation of total base in blood serum. D. D. VAN SLYKE, ALMA HILLER and K. C. BERTHESEN. *J. Biol. Chem.* **74**, 659-75(1927).—"A rapid and precise gasometric micro-detn. of iodates in the manometric app. of Van Slyke and Neill (*C. A.* **18**, 3615), by the reaction, $2NaIO_3 + 3N_2H_4 = 2NaI + 6H_2O + 3N_2$, is described. Sulfates are detd. by the gasometric estn. of the iodate dissolved when the sulfate soln. is equilibrated with excess of solid $Ba(IO_3)_2$. The reaction, $Ba(IO_3)_2 + Na_2SO_4 = 2NaIO_3 + BaSO_4$, does not go completely from left to right, but reaches an exactly reproducible equil., fixed by the relative solubilities of $BaSO_4$ and $Ba(IO_3)_2$. For the detn. of the total base in the serum, the latter is ashed with HNO_3 and H_2SO_4 and the bases are converted into sulfates. The SO_4 is then detd. by the above procedure. The base from 0.16 cc. of serum suffices for a detn., with an av. error of 0.8% of the amt. detd."

A. P. LOTHROP

An electrolytic method for the determination of sodium plus potassium. J. L. STODDARD. *J. Biol. Chem.* **74**, 677-88(1927).—The method is designed for the detn. of Na + K, and thus of Na by difference if K is detd. The material is ashed, dissolved and Mg and Ca are removed by pptn. Part of the remaining soln. is electrolyzed in an app. consisting mainly of one test tube fused inside another with Hg in each tube and a passage through the wall of the inner tube. Under an e. m. f. of 110 v. the negative ions migrate to the Hg in the outer tube; the positive ions migrate to the Hg in the inner tube where an amalgam is formed which is removed and titrated. Results check within 2% when the quantity of Na + K is equal to at least $\frac{1}{4}$ that contained in 1 cc. of plasma. The method was designed primarily for use with the new and accurate method of Fiske for the detn. of K. The method may be used with whole blood, plasma and urine.

A. P. LOTHROP

The application of the ethyl iodide method to the determination of the circulation rate in women. WINIFRED C. CULLIS, OLIVE RENDEL and ELLEN DAHL. *J. Physiol.* **62**, 104-14(1926).—Av. values for 11 women (19 to 25 yrs.) were: circulation l. per min. 7.5; stroke vol. cc. 100; stroke index, cc. per kg. 1.67.

J. F. LYMAN

Colorimetric tryptophan determination in proteins. J. TILLMANS and A. AET. *Biochem. Z.* **178**, 243-4(1926); cf. *C. A.* **22**, 1251.—Reply to Fürth (*C. A.* **20**, 3306).

S. MORGULIS

Cell respiration. VI. The function of the adrenal cortex and the substance Cxii. A. V. SZENT-GYÖRGYI. *Biochem. Z.* **181**, 433-7(1927); cf. *Nature* **119**, 782-3; cf. *C. A.* **21**, 2293.—The cortices of adrenals were finely chopped and extd. with $2\frac{1}{2}$ vol. of MeOH for 1 hr. while the material was mixed by passing CO_2 through it. The material was then pressed quickly through linen and finally filtered through a Büchner funnel. The filtrate was at once placed on ice and treated with $\frac{1}{10}$ vol. of 25% $Pb(OAc)_2$. The ppt. was centrifuged off after $\frac{1}{2}$ hr., suspended in about $\frac{1}{4}$ of the original vol. of MeOH, and again centrifuged, whereby most of the adrenaline was left in soln. The ppt. was then suspended in $\frac{1}{8}$ vol. ice-cold water and acidified with 50% H_2SO_4 until Congo turned blue, the excess of acid being neutralized with $NaHCO_3$. The fluid was centrifuged and preserved in a thermos bottle with a mixt. of CO_2 snow and petroleum ether. A method is described also for further purification of the $Pb(OAc)_2$ ppt. The purified Cxii substance is easily sol. in H_2O and MeOH, fairly sol. in dry acetone, less so in ether and entirely insol. in petroleum ether. It seems to be of the nature of a thiophenol, readily reduces I but not permanganate.

S. MORGULIS

Method for determining the catalase content of the blood. P. J. GOLZOW AND W. D. JANKOWSKY. *Biochem. Z.* **185**, 63-9(1927).—The KMnO_4 method of Bach and Zubkova for detg. the blood catalase must be modified in order to obtain reliable results, the amt. of H_2O_2 used being increased from 20 mg. to 40-60 mg. Furthermore, to avoid loss of catalase activity the dild. blood soln. should contain a trace of EtOH (1:5000). The results of numerous investigators who made use of the original Bach and Zubkova method must therefore be submitted to a critical examn. S. M.

Colorimetric method for determining the degree of saturation of blood with oxygen. GYULA HOLLÓ AND ISTVAN WEISS. *Biochem. Z.* **185**, 373-8(1927).—A special colorimeter is described by means of which the relative proportion of oxy-hemoglobin (yellowish red) and hemoglobin (violet) can be detd. by the color nuance of a layer of hemolyzed blood. S. MORGULIS

Note on the Hagedorn-Jensen microchemical sugar determination in blood. F. MARTINSON. *Biochem. Z.* **185**, 400-4(1927).—The pipet used for measuring the $\text{K}_3\text{Fe}(\text{CN})_6$ soln. must be drained 5 min. or else rinsed with H_2O to reduce the error of the method to 2%. S. MORGULIS

Contribution to the method of Hagedorn-Jensen for blood sugar determination. L. CSIK AND A. JUHÁSZ. *Biochem. Z.* **185**, 420-2(1927).—A small quantity of blood (30-120 mg.) is weighed on a torsion balance in a glass dipper 0.5 cm. deep and 0.7 cm. diam. whereby the shortcomings of the absorption of blood with filter paper are avoided. S. MORGULIS

Precipitation of diamino acids with mercuric acetate and sodium carbonate. GÜNTER NAGELSCHMIT. *Biochem. Z.* **186**, 322-6(1927).—An appropriate mixt. of 25% $(\text{AcO})_2\text{Hg}$ and satd. Na_2CO_3 causes practically the complete removal of all amino acids obtained from protein. S. MORGULIS

Vital staining and adsorption. H. A. KREBS AND DAVID NACHMANSOHN. *Biochem. Z.* **186**, 478-84(1927).—A parallelism is shown between the vital-staining capacity of a number of dyes and their adsorption by kaolin. S. MORGULIS

Method for determining copper and iron and the copper content of blood serum. OTTO WARBURG. *Biochem. Z.* **187**, 255-71(1927).—Cu is detd. by its effect on the oxidation of cysteine. The latter is, of course, also promoted by Fe or Mn, but the last-mentioned metals are inhibited by pyrophosphoric acid, which has no effect on the Cu. The detn. is carried out in a special 15-cc. vessel which consists of 2 compartments and is provided with a manometer. The larger compartment contains 2 cc. of 0.2 M $\text{Na}_4\text{P}_2\text{O}_7$ of definite p_{H} , while into the adjacent smaller compartment are placed 5-6 mg. cysteine-HCl dissolved in 0.1 cc. H_2O and 0.1 cc. of the fluid, the Cu content of which is to be detd. The flask is connected with a H_2O manometer and is shaken in a thermostat at 20° for 10 min. when the contents of the 2 compartments are allowed to mix. Directions are given for the prepn. of the $\text{Na}_4\text{P}_2\text{O}_7$ soln. as well as for the purification of cysteine; also the prepn. of the Cu standard and the method for cleaning the glassware are fully discussed. In the oxidation 1 mg. cysteine uses up 37-38 cu. mm. O_2 and the first half of the process proceeds with const. velocity. It is this part of the oxidation process which is important for the Cu detn., the initial velocity being almost exactly proportional to the Cu concn. The detn. is made in 3 vessels: one, control, contg 0.1 cc. H_2O ; the second, 0.1 cc. of the analyzed soln. and the third 0.1 cc. of the Cu standard ($= 2 \times 10^{-4}$ mg Cu). Designating the initial velocities as a_1 , a_2 and a_3 , the Cu content of 0.1 cc. soln. $x = ((a_2 - a_1)/(a_3 - a_2)) \times 2 \times 10^{-4}$ mg. The oxidation velocity depends upon the p_{H} , the Cu value at p_{H} 7.63 being 900,000. The influence of Cu on the oxidation of cysteine is affected by Fe but not by Mn. Provided the pyrophosphate soln. is free from Cu, the method is sensitive to the extent of detg. 10^{-8} mg. Cu. For the Fe detn. the same principle is followed but the buffering is with borate instead of pyrophosphate. Where both Cu and Fe are present in the ash soln. (which should have an acidity of 0.1-0.05 N) the Fe is detd. from the difference in the results by the borate (Cu + Fe) and pyrophosphate procedure (Cu). Mn is also active in the borate buffer, but the 3 metals can be differentiated by the p_{H} of the mixt. However, the sep. detn. of these metals in a mixt. of all has not yet been accomplished. S. MORGULIS

The determination of guanidine and its supposed occurrence in the tetany urine. F. M. KUEN. *Biochem. Z.* **187**, 283-306(1927).—The older methods for detg. methylguanidine are not suitable for quant. analysis. The methylguanidine is oxidized to creatine. The pptn. of the guanidine with picric acid is likewise unreliable especially as creatinine cannot be quantitatively removed from urine by a preliminary ZnCl_2 pptn. The pptn. of guanidine with picrolonic acid is the method of choice, and this is not contaminated with creatinine. The presence of the methylguanidine could

be demonstrated by the color reaction of Sagakuchi after the ppt. was decompd. with H_2SO_4 and the picrolonic acid extd. with ether. Likewise, added quantities of guanidine were recovered from normal urine as picrolonate to the extent of 50–90%. The color reaction of Sagakuchi, which consists in the development of a red coloration when methylguanidine in alk. soln. is treated with α -naphthol and NaOCl , can be used as a basis of a colorimetric detn. provided the concn. is more than 50 mg. per l., while smaller quantities can be closely estd. Tests for methylguanidine made on normal and tetany urine by means of the nitroprusside, the Sagakuchi or the gravimetric picrolonic acid reaction have all given neg. results.

S. MORGULIS

A new colorimetric method for the determination of lactic acid in the blood. ZACHARIAS DISCHE AND DANIEL LASZLO. *Biochem. Z.* **187**, 344–62(1927).—The reaction of lactic acid with hydroquinone and H_2SO_4 is utilized for the detn. The mixt. is boiled 15 min. in the water bath when max. color intensity is attained. The optimum H_2SO_4 concn. is such that lactic acid/ H_2SO_4 is 1.4 or 1.5; with higher concns. of H_2SO_4 the color begins to fade out. As for the color of the hydroquinone soln. itself, it was found to be present only in a mixt. contg. Cu and Ca ions, but varies inversely with the concn. of the hydroquinone. This source of error is therefore easily removed by the proper adjustment of the concn. of the color reagent. The color reaction is proportional to the lactic acid concn. within the limits of 0.001 to 0.020%. The color undergoes little change with time, but the relative color intensities of a series remain the same even after 24 hrs. Though the reaction is not specific for lactic acid, and is also produced by aldehyde, methylglyoxal, diacetone or glucose, it is neg. with acetone, diacetic acid, amino acids, urea, uric acid, creatine, creatinine, casein or casein-hydrolyzate. In this respect, however, this method is less open to objection than all other previously described methods for detg. lactic acid. For detg. the lactic acid in blood, this is deproteinized according to the procedure of Servant. To 0.5 cc. blood are added 2.5 cc. H_2O , then 0.5 cc. concd. H_2SO_4 and 0.5 cc. of 5% NaPO_3 . The ppt. is centrifuged off, and 2.5 cc. of the supernatant liquid is put into a centrifuge tube and treated with 0.5 cc. 2.5% CuSO_4 and enough $\text{Ca}(\text{OH})_2$ to change the color to a deep turquoise blue. After centrifuging again 1 cc. of the liquid is used for the lactic acid detn. The standard is prepd. by dissolving 0.108 g. Li lactate in 100 cc. H_2O (1 cc. = 1 mg. lactic acid), which is dild. to give approx. the same concn. as the unknown (for normal blood about 0.02 mg. = 1 cc.). To 1 cc. of the dild. standard, 1 cc. of H_2O and 1 cc. blood filtrate in sep. test tubes are added 0.1 cc. 10% CuSO_4 , 4 cc. concd. H_2SO_4 (cooling) and 0.1 cc. of 20% alc. soln. of hydroquinone. The tubes are now immersed for 15 min. into a boiling water bath. The colorimetric comparison is made by the following procedure. Thirty-five cc. of the standard and of the blood are transferred to clean tubes of a Walpole comparator and enough of the blank is added with a graduated pipet to the darker soln. until both tubes match in color. The lactic acid concn. is then calculated from the dild. data. The blood lactic acid is obtained by further multiplication by 10, since the blood filtrate represents a final dild. of 1:10. S. M.

Studies on the preparation of succindehydrogenase. NILS ANDERSON. *Skand. Arch. Physiol.* **52**, 187–98(1927).—About 100 g. of ground muscle is put on a piece of cloth spread over a shallow dish, and to this is added 100 cc. 0.25% NaCl soln. After rubbing for a few min. with a pestle the muscle substance is squeezed out by tightening the cloth, and the liquid is discarded. The cloth with the muscle substance is again spread out over the dish and covered with fresh 0.25% NaCl , and this washing process is continued until the muscle substance becomes colorless. This usually requires about a liter of NaCl soln. and takes up 20 min. Then the muscle is treated with an equal wt. of $M/15 \text{ Na}_2\text{HPO}_4$ or K_2HPO_4 , thoroughly triturated and shaken slowly for an hr. The liquid which is now obtained by centrifuging contains the succindehydrogenase.

S. MORGULIS

Errors in the iodometry of Bang's method for the determination of lipoids in the blood. H. HECKSCHER AND O. K. MÜLLER. *Skand. Arch. Physiol.* **52**, 222–33(1927).—In Bang's method the analysis of lipoids depends upon the oxidation with $\text{K}_2\text{Cr}_2\text{O}_7 + \text{H}_2\text{SO}_4$ and the detn. of residual $\text{K}_2\text{Cr}_2\text{O}_7$ by means of I_2 titration. The I_2 required in titrating the blank is invariably less than the calcd. amt., the loss representing 5–13% of the added $\text{K}_2\text{Cr}_2\text{O}_7$. This loss is caused by a reduction of $\text{K}_2\text{Cr}_2\text{O}_7$ in the greatly overheated soln. when H_2SO_4 is added and is associated with impurities both in the acid and in the $\text{K}_2\text{Cr}_2\text{O}_7$. The reagents must be therefore selected with great care as to their chemical purity, and blanks must be run every time fresh solns. are made up. To avoid overheating, the dild. with H_2O is made before the addn. of the H_2SO_4 . Unless these conditions are carefully observed the results of the analyses are too high and altogether unreliable.

S. MORGULIS

Micro-estimation of carbon. Application to the determination of urinary carbon. MAURICE NICLOUX. *Bull. soc. chim. biol.* 9, 639-76(1927); cf. *C. A.* 21, 1945, 3211.—Particular directions are given for the detn. of urinary C by the argento-sulfochromic method. L. W. RIGGS

Improvement in the method of destroying organic matter in the micro-estimation of phosphorus in the blood. MICHEL MACHEBOEUF AND (Mlle.) GENEVIEVE ZWILLING. *Bull. soc. chim. biol.* 9, 697-9(1927).—The nitromagnesian method was abandoned as inexact. The sulfo-nitric method, for the destruction of org. material was performed as follows: In a 50-cc. Kjeldahl flask was placed exactly 2 cc. of serum and 1 cc. of H_2SO_4 , the mixt. was heated until white fumes ceased to be evolved (about 10 min.), was cooled and 2 cc. of HNO_3 was added and boiled to expel the nitrous gases when the liquid was cooled and 0.2 g. of pulverized $KMnO_4$ was added and gently heated. If after several min. the liquid turned brown an additional 0.2 g. of $KMnO_4$ was added and the mixt. again gently heated. If the resulting liquid is nearly colorless, it is ready for pptn. by molybdate. If the liquid is violet or violet-brown in color, it is dild. with 6 cc. of H_2O and is heated to boiling when sufficient satd. soln. of $(NH_4)_2C_2O_4$ is added drop by drop to decolorize the excess of $KMnO_4$ before pptg. with molybdate. L. W. RIGGS

Micro-method for determining phosphoric acid in combination as organic esters in blood and serum. M. MACHEBOEUF. *Bull. soc. chim. biol.* 9, 700-2(1927); cf. *C. A.* 21, 2005.—The pptn. of proteins by CCl_3CO_2H leaves the mineral and ethereal phosphates in soln. Ten cc. of the filtrate from the protein ppt. is warmed on the water bath exactly 5 min. with 1 cc. concd. H_2SO_4 and 2 cc. satd. NH_4NO_3 soln., when 6 cc. of a 20% $(NH_4)_2MoO_4$ soln. is added and the mixt. is kept on the water bath for 10 min. Under these conditions the mineral phosphates are pptd. but not the ethereal phosphates. By detg. the total phosphate in a sep. portion of the filtrate from the protein ppt. the ethereal phosphate is found by difference. L. W. RIGGS

Estimation of glutathione. A. BLANCHETIERE AND L. MELON. *Compt. rend. soc. biol.* 97, 242 4(1927).—Starch paste was retained as an indicator of the end reaction instead of the nitroprussiate recommended by Thompson and Voegtlin (cf. *C. A.* 21, 607, 954.) L. W. RIGGS

Measure of complex albumins by their "protein error." R. GOIFFON AND HANDIQUET. *Compt. rend. soc. biol.* 97, 311-3(1927); cf. following abstract.—The colorimetric measure of H-ion concn is modified by the presence of proteins (the protein error of Sørensen). If a definite quantity of a colored indicator is added to a very stable buffer soln., of which the p_H is within the zone of sensibility of the indicator, a color characteristic of the p_H is obtained. If now a drop of 1% egg albumin is added there is a modification of the tint indicating a different p_H . But the small quantity of albumin introduced is incapable of making the p_H of a stable buffer change and electromeasurement shows that it does not change. This error is proportional to the quantity of added protein and its measure may be used to est. the amt. of protein. Directions are given for estg. proteins by this method. L. W. RIGGS

Denaturation of albumins and "protein error." R. GOIFFON AND HANDIQUET. *Compt. rend. soc. biol.* 97, 434 5(1927), cf. preceding abstr.—The protein error is detd. as follows. Of 2 portions of equal vols. of 5% egg albumin, one is heated 5 min. in the boiling water bath, the other is not. The first portion requires a much greater quantity of HCl (index of denaturation) to give the same tint with Orange IV. Solns. of albumin heated for 30 min. in the boiling water bath do not require more HCl than if heated 5 min. The increased quantity of HCl required to neutralize not overheated solns. of albumin is at first apparent after heating for 15 min. at 60° ; a large and sudden increase in the index occurs between 70° and 80° and the max. at 85° . The presence of electrolytes in the soln. of albumin does not modify the index of denaturation. Slight variations of p_H between 7 and 8 do not modify the figures obtained. L. W. RIGGS

Arrangement of apparatus for measuring the velocity of coagulation of the blood. R. FEISLY. *Compt. rend. soc. biol.* 97, 467-8(1927).—The app. is illustrated and the procedure is described. L. W. RIGGS

Microelectrode for determining the true c_H . HANS WINTERSTEIN. *Arch. ges. Physiol.* (Pflüger's) 216, 267 70(1927).—An app. for use with minute amounts of material is described and illustrated. G. H. S.

A conductivity cell for continuous measurements of respiratory rate. R. B. HARVEY AND L. O. REGEUMBAL. *Plant Physiology* 1, 205-6(1926).—Description (with figure) of a cond. cell that has some advantages over former types for measuring quick changes in the rate of CO_2 production when rapid fluctuations in the rate of respiration of tissues are under investigation. WALTER THOMAS

Estimation of bismuth in urine. H. B. RASMUSSEN, K. A. JACKEROTT AND S. A. SCHOU. *Dansk. Tids. Farm.* 1, 391-403(1927).—The reliability has been investigated of the various methods employed in the estn. of the small amts. of Bi present in the urine and organism during treatment of syphilis with Bi salts. The methods of Cuny and Poirer (*C. A.* 18, 208) and Laporte (*C. A.* 18, 1259) were not found reliable. Also the 2 methods proposed by Kürthy and Müller (*C. A.* 19, 529, 2218) were not considered suitable. The method of Leonhard (*C. A.* 20, 3044), employing the observation by Strone, that Bi salts and iodides in acid soln. give a yellow, in concd. solns. a brownish, colored complex BiI_3 , was found most practical. This method was systematically investigated by measurements of the light absorption of the complex with the aid of a spectrophotometer and light of detd. wave length. A soln. of 0.1 g. Bi per l. was used as a standard, prepd. by dissolving 0.115 g. Bi_2O_3 in 1 l. *N* H_2SO_4 . 0.5-2.5 cc. of this soln. (0.05-0.25 mg. Bi) and 1 cc. 10% KI soln. were dild. to 25 cc. with *N* H_2SO_4 . These mixts. were distinctly yellow colored. Preliminary expts. showed that a liquid layer, 6.5 cm. high, of a soln. contg. 0.1 mg. Bi in 25 cc., absorbed blue light up to a wave length of 4500 Å. U. The blue line 4359 Å. U. obtained with a quartz Hg lamp was therefore chosen for the quant. estn. of Bi. The measurements showed that the light absorption was proportional to the concn. of Bi and that a variation in the acid concn. from 1 to 2*N* and even a large excess of KI had no influence. The amts. of ferric salts normally present in urine caused too high results, but this error could be compensated for by addn. of citric acid. Hg salts did not influence the accuracy of the method. The estns. in urine were carried out as follows: Mix 100 cc. urine with 50 cc. 68% HNO_3 in a Kjeldahl flask. Place the flask in an inclined position on a wire gauze and evap. nearly to dryness, care being taken toward the end of the destruction in respect to the considerable amts. of NH_4NO_3 in the residue, which occasionally may cause small explosions. When cold add 3 cc. concd. H_2SO_4 and boil until the mixt. is fuming. Add 1-2 cc. concd. HNO_3 , drop by drop, and evap. again. After cooling, the mixt. should now be colorless; if not, add more HNO_3 and repeat the boiling. (If the urine contains Ag salts, ppt. with a few drops of HCl and filter.) Add 10 cc. of a satd. soln. of oxalic acid to the cold mixt. and boil until fumes appear. This is necessary to remove the last trace of HNO_3 , which otherwise causes too high results. Dil. the cooled mixt. with hot water to about 20 cc. and filter. Add 1 cc. 10% KI soln., 1 cc. 10% Na_2SO_3 soln. and 1 cc. 15% sodium citrate soln. and dil. to 25 cc. If pptn. of salts takes place increase the vol. to 50 cc. The color intensity is now measured with a colorimeter. A soln. prepd. by diluting 1.0 cc. Bi standard soln., 1 cc. 10% KI soln. and 1 cc. 10% Na_2SO_3 soln. to 25 cc. with *N* H_2SO_4 is used for comparison. Calcn.: (h_{stand}/h_x) ; 0.1 = mg. Bi per 100 cc. urine, where h_{stand} is the height of the liquid used for comparison and h_x the height of the liquid to be tested. At low concns. of Bi in the urine, 0.5 cc. standard Bi soln. may be used in the prepn. of the comparison liquid; at higher concns. up to 4 cc. On standing, particularly in sunlight, the solns. liberate I. In diffuse daylight the mixts. may be kept unchanged for some time. The results obtained colorimetrically proved to be in agreement with the spectrophotometric measurements and the method is sufficiently accurate for clinic use. A summary in English is given.

D. THUMSEN

The gravimetric determination of basal metabolism. H. S. HALCRO WARDLAW. *Med. J. Australia* 1, 506-9(1927).—The patient who has been fasting for 12-16 hrs. inhales air from the outside, exhaling into a Douglas bag. After the allotted time has expired, the bag is connected to a train contg. CaCl_2 , moist soda-lime and CaCl_2 bottles, water trap and lime-water, resp., to which a suction pump is affixed. The increase in the weight of the moist soda-lime and second CaCl_2 bottles is the weight of the CO_2 absorbed.

R. C. WILLSON

A rapid quantitative estimation of sugar in urines. T. J. F. MITSCHKE. *Virginia Medical Monthly* 54, 251-2(1927).—M. advocates the titration of 5 cc. of Benedict's quant. soln. with undild. urine.

R. C. WILLSON

C—BACTERIOLOGY

A. K. BALLS

Cytochrome in yeast cells. II. HANS V. EULER, HERMANN FINK AND HARRY HELLSTRÖM. *Z. physiol. Chem.* 169, 10-51(1927); cf. *C. A.* 21, 2009.—The absorption spectrum of the respiratory pigment cytochrome was photographed in suspensions of top and bottom yeast in both oxidized and reduced form. In top yeast *R* the selective absorption of the reduced form is much more pronounced than in bottom yeast. Dried preps. of top yeast are almost as rich in cytochrome as the fresh yeast itself,

while dried bottom yeast shows a more feeble selective absorption than the fresh cells. A relationship seems to exist between catalase action and cytochrome content as shown by a more energetic decompn. of H_2O_2 by dried top yeast rich in cytochrome than by dried bottom yeast of insignificant cytochrome content. By means of the spectrographic method the absorption curves of pyridine-hemochromogen and of the unstable yeast hemochromogen were detd., and a quant. estn. of the hemochromogen content of pyridine exts. from yeast was undertaken, especially the calcn. of concn. from the selective absorption at the max. at 557μ . Hemochromogen-pyridine solns. of known content served as the standard. In contrast to the cytochrome content, the hemochromogen content of top and bottom yeasts showed only slight variations. The ratio of hemochromogen-Fe to total Fe, previously reported to be $1/160$, is now shown to be $1/80-1/120$. It is noteworthy that top yeast, which gives a much stronger cytochrome spectrum, showed lower hemochromogen content than bottom yeast in which cytochrome appears less distinctly. The hemochromogen is therefore no direct index of cytochrome content. In bottom yeast the reduced cytochrome spectrum lacked the A band at 6040 A. U., suggesting a partial replacement by a "hemochromogen-like complex" or Keilin's "modified cytochrome." Copro-yeast gave the highest value for hemochromogen.

A. W. DOX

The growth of *Bacillus coli* in a chemically defined medium. E. AUBEL. *Ann. physiol. physicochem. biol.* 2, 73-94(1926); *Physiol. Abstracts* 11, 402. Pyruvic acid is formed from glucose, and at this stage H is set free in anaerobic culture. The process of oxidation amounts to departure of II where there is no H acceptor. Butyraldehyde undergoes a process of oxidation reduction; it yields acid as well as alc. This is the effect of the loose II. Pyruvic fermentation is distinct from lactic acid fermentation. The stage $1/2\text{C}_6\text{H}_{12}\text{O}_6 = \text{CH}_3\text{COCOOH} + \text{H}_2 - 7.800$ cal. furnishes the material necessary for living matter; whereas $1/2\text{C}_6\text{H}_{12}\text{O}_6 = \text{CH}_3\text{CHOHCOCOOH} + 14.500$ cal. by coupling permits the preceding reduction in anaerobic conditions. The role of O in aerobic culture is discussed and a new conception of respiration is considered. H. G.

Anaphylaxis in microbes. E. BACHRACH. *Arch. intern. physiol.* 26, 147-54 (1926); *Physiol. Abstracts* 11, 504.—Preliminary expts. are made with a strain of lactic acid enzyme poisoned by a trace of TI salts. H. G.

Influence of the medium on lactic acid bacillus. E. BACHRACH AND H. CARDOT. *Arch. intern. physiol.* 26, 155-68(1926); *Physiol. Abstracts* 11, 504.—Temps. above 40° cause the bacilli to group themselves in long chains, the culture returning to normal at 36° . Prolonged poisoning gradually produces immunity, increased resistance to high temps., and elevation of optimum temp.; since these variations are stable on transmission, new strains can be produced with distinct physiol. characteristics. Thus the previous history of the strain must be considered as well as the external medium when investigating the physiol. reaction. H. G.

Some physico-chemical experiments on the effect of organo-therapeutic substances on fermentation. L. P. ROSENOW. *Fermentforschung* 8, 533(1926); *Physiol. Abstracts* 11, 262.—The accelerating action on yeast fermentation of various thyroid prepn. runs parallel to their electrolyte content. H.-G.

Hexylresorcinol in oral antisepsis with special reference to solution S.T. 37. WM. A. FEIKER AND VERAER LEONARD. *Dental Cosmos* 69, 882-92(1927); cf. C. A. 20, 3780.—A soln. of hexylresorcinol in a mixt. of 30% glycerol and 70% H_2O and contg. 1 mg. of solute per cc. has a surface tension of 37 dynes per cm. (S. T. 37). This soln. is chem. stable, non-toxic, free from objectionable taste, non-irritating, and highly penetrating as a result of its powerful surface tension reducing properties. It does not stain, and exerts a marked bactericidal action within 15 sec., being unaffected by the presence of org. matter. At body temp the usual pathogenic bacteria are destroyed completely in less than 15 sec., spirochetes, ameba and flagellates in less than 5 sec. Practically complete disinfection of the gum margin is attained in 5 min. J. S. H.

Propionic acid fermentation. II. A. I. VIRTANEN. *Soc. Sci. Fennica, Commentationes Phys.-Math.* 2, No 19-30, 13 pp.—Expts. show that glucose is esterified with phosphates during a propionic acid (I) fermentation. A dry bacterial prepn. was made by growing in a culture medium of 20 g. peptone, 10 g. Na lactate, 1.5 g. K_2HPO_4 , 1000 cc. H_2O at p_{H} 6.8 and 35° , centrifuging, suspending the pptd. bacteria in H_2O , again centrifuging and drying in thin layers on a porous plate; fermentations of glucose (II) inoculated with this dry bacterial prepn. and in the presence of PhMe which acts as a protoplasmic poison yields $(\text{CH}_3\text{CO}_2\text{H})_2$ and AcOH ; similar fermentations with living bacteria and without the protoplasmic poison gave $(\text{CH}_3\text{CO}_2\text{H})_2$, AcH , $\text{C}_2\text{H}_5\text{CO}_2\text{H}$, AcOH and CO_2 ; washed and dried bacteria are lacking in the coenzyme which causes esterification of II with phosphates; the phosphatase coenzyme of lactic

acid bacteria can replace the similar coenzyme of the propionic acid bacteria which is removed from the latter by washing and drying. Lactic acid (III) which is quant. fermented by living propionic acid bacteria yielding I, AcOH and CO₂, remains unfermented when PhMe is added to the culture. The results show that in the fermentation of II with propionic acid bacteria there are at least 2 distinct fermentations, one being $\text{III} \rightarrow (\text{CH}_3\text{CO}_2\text{H})_2 + \text{AcOH}$, and the other $\text{III} + (\text{phosphatase coenzyme}) \rightarrow \text{III} \rightarrow \text{I} + \text{AcOH} + \text{CO}_2$.

N. A. LANGE

The Gram reaction. PH. LASSEUR AND SCHMITT. *Ann. inst. Pasteur* 41, 554-75 (1927) There is a stage of max. speed of decolorization for each bacterial species, usually coincident with the stage where the cytoplasm is undifferentiated and homogeneous. Variation in the nutritive media in which the bacteria are grown has no appreciable effect on their resistance to decolorization. In a narrow range the speed of decolorization is not modified by the temp. of the wash water, but great difference is observed in a range of 4° to 50°. Decolorizing liquids operate about 3 times as fast at 16° as at 4°. The speed of decolorization also depends greatly on the method of staining, results of comparable value can be obtained only when use is made of (1) the same stain, (2) the same staining technic and (3) recently prepd. reagents and bacterial preps. Strong concns. of counterstains may displace the violet-black of the Gram stain and lead to error. Weak concns. do not have this effect. Within certain limits the speed of decolorization is inversely proportional to the concn. of I used in the staining, the duration of the I treatment and the temp. of the I soln. Bacteria vary greatly in their individual resistance to decolorizing reagents, and therefore quant. use of the Gram stain permits the recognition of species differentiation not detectable by the usual qual. method.

E. R. LONG

Identification of pathogenic bacteria of the intestine. LOMRY AND GILLET. *Ann. inst. Pasteur* 41, 618-67 (1927) The enzymes secreted by the pathogenic bacteria of the intestine vary with the microorganism. Fermentation of sugars is a means of differentiation, which may be confirmed by agglutination. Prolonged rejuvenation is sometimes necessary to bring out differences.

E. R. LONG

Some factors governing the production of diphtheria toxin in artificial culture media. C. S. GIBBS AND L. F. RETTGER. *J. Immunol.* 13, 323-44 (1927).—Sugar-free veal broth prepd. by fermenting lean veal with *B. coli* for 12 to 15 hrs., and adding to the filtered broth 2% Difco Proteose Peptone and 0.5% NaCl, and adjusting the liquid to a H-ion concn. of 7.5 or 7.6, made a favorable culture medium for the production of diphtheria toxin. Sugar-free veal broth would not support toxin formation unless combined with certain substances in Difco Proteose Peptone, Witte's Peptone, or a fraction of Difco Bacto-Peptone which is sol. in cold 50% alc. but insol. in cold 80% alc. The addn. of certain pure amino acids, except in very small quantities, interfered with toxin production. Cystine and tryptophan were favorable in amts. not exceeding 0.5%, aiding both growth and toxin production. Com. peptones contg. large quantities of proteose were especially favorable for diphtheria toxin production. Media contg. digests prepd. by 48 hrs. peptic and 3-5 hrs. tryptic digestion of blood fibrin produced "peptones" suitable for the elaboration of potent diphtheria toxins when used in sugar-free veal infusion broths and inoculated with habituated, virulent strains of *C. diphtheriae*. Good toxin production was secured when such digests were added to veal broths in the proportion of 2% solid weights. The biuret, Sørensen and Van Slyke tests were useful in detg. the points at which digestion should be interrupted to obtain digests yielding potent diphtheria toxin. Toxin was formed only when strong biuret tests were secured with the fibrin and veal digest filtrates and when the formal titration figures closely proximated or exceeded those of the Van Slyke test.

E. R. LONG

Energy relations in the metabolism of autotrophic bacteria. L. G. M. BAAS-BECKING AND G. S. PARKS. *Physiol. Rev.* 7, 85-106 (1927).—A review of the dynamics involved. A limited no. of inorg. geochem. reactions are thermodynamically possible. Only a few have been studied microbiologically. Green plants probably do not have a monopoly of photosynthesis. The existence of Fe bacteria is not proven.

E. R. LONG

The production of acetylmethylcarbinol by *Clostridium acetobutylicum*. P. W. WILSON, W. H. PETERSON AND E. B. FRED. *J. Biol. Chem.* 74, 495-507 (1927).—Qual. tests have shown the production of acetylmethylcarbinol (CH₃CHOHCOCH₃) from more than 20 carbohydrates by the Me₂CO-BuOH-producing organism *Clostridium acetobutylicum* (Weizmann) and a quant. study of the production of this compd. has now been made at various stages of the fermentation. This substance is a regular end-product of the reaction, the amts. formed averaging 300 to 400 mg. per l. It is formed at about the same time as the acetic and butyric acids and all 3 probably have

the same precursor. Its production can be increased by the addn. of phosphates and decreased by proteins and is more closely assocd. with the formation of the acids than with that of the Me_2CO and BuOH . The amt. reaches a max. and const. level at a time when about 75% of the solvents have been formed and 40-50% of it is produced when only 10-15% of the solvents have been formed.

A. P. LOTHROP

The soluble specific substance of pneumococcus. V. The chemical nature of the aldobionic acid from the specific polysaccharide of type III pneumococcus. MICHAEL HEIDELBERGER AND W. F. GOEBEL. *J. Biol. Chem.* **74**, 613-8(1927); cf. *C. A.* **21**, 2288.—The aldobionic acid isolated from the hydrolytic products of the sp. polysaccharide of type III pneumococcus is a compd. of glucuronic acid and glucose, combined in glucosidic linkage through the aldehyde group of the glucuronic acid and one of the C atoms of glucose (which one remains to be detd.).

A. P. LOTHROP

The soluble specific substance of Friedländer's bacillus. IV. The nature of the hydrolytic products of the specific carbohydrate from type A Friedländer's bacillus. W. F. GOEBEL. *J. Biol. Chem.* **74**, 619-29(1927), cf. *C. A.* **20**, 614.—The sol. sp. substance of the type A Friedländer bacillus yields on hydrolysis an aldobionic acid, glucose, and a 2nd unidentified sugar acid, the compds. occurring approx. in the ratio 1:1:1. The aldobionic acid consists of a mol of glucuronic acid linked through its reducing group to a mol of glucose and is isomeric with the acid similarly derived from the sol. sp. substance of type III pneumococcus (cf. preceding abstr.). The polysaccharide is apparently a condensate of 2 mols. of aldobionic acid and 1 mol. of glucose.

A. P. LOTHROP

Non-protein antigens of the bacteria. J. FREUND. *J. Elisha Mitchell Sci. Soc.* **42**, 135-8(1926).—F. has found an alc.-sol. antigen in *Streptothrix*. The smallest dose of this material giving complement fixation in rabbits was 0.002 mg. This antigen is chemically distinguishable from the lipid antigens of tubercle and diphtheria bacilli.

A. I. MEHRING

Calcium precipitation due to microorganisms. CARL NÆSLUND. *Biochem. Z.* **184**, 1-9(1927).—Exptl. evidence is presented to show the pptn. of Ca and formation of concretions in cultures of microorganisms, apparently due to lowering of the acidity.

S. MORGULIS

Quantitative dismutation of methylglyoxal to lactic acid through *Bacillus Delbrücki* as well as *Bacterium lactis aerogenes*. Experiments on the variable behavior of phenylglyoxal in this reaction. CARL NEUBERG AND ERNST SIMON. *Biochem. Z.* **186**, 331-6(1927).—*B. Delbrücki* converts both methylglyoxal and phenylglyoxal into *l*(+) optically active mandelic acid. *B. lactis aerogenes* converts methylglyoxal quickly and quantitatively into racemic lactic acid while phenylglyoxal is changed quantitatively to *d*(-) mandelic acid.

S. MORGULIS

Studies on iodine as a biogenous element. XI. The effect of iodine on yeast. I. K. SCHARRE AND W. SCHWARTZ. *Biochem. Z.* **187**, 159-79(1927); cf. *C. A.* **21**, 3383.—Inorg. salts of I_2 in small concns. stimulate the rate of multiplication of yeast, but there was no evidence that the actual yield of mass was likewise increased. The yeast stores up I_2 , part of which seems to be in loose combination. I_2 apparently plays no significant role in the metabolism of yeast.

S. MORGULIS

The inhibiting power of some vegetable essential oils towards various pathogenic microbes. A. MORILL AND A. ROCHAIX. *Parfumerie moderne* **19**, 184(1927); cf. *C. A.* **17**, 122.—The min. quantities of oils of thyme, *Eucalyptus citriodora*, Australian eucalyptus, lavender, lemon and orange, required to prevent the development of *B. Eberthii*, staphylococci and *B. Loeffleri* on agar medium, were detd. The order of decreasing activity is not the same as the order of decreasing antiseptic power, as previously detd.; e. g., oil of lemon was one of the most active antiseptics, but has a relatively low inhibiting power. Considerable difference was observed in the activity of 2 different oils of thyme (one with high thymol and the other with high carvacrol content) and also of the 2 different eucalyptus oils, indicating the importance of variations in compn. due to differences in botanical origin. Also in *Compt. rend. soc. biol.* **96**, 1311-2(1927).

A. PAPINEAU-COUTURE

Resistance of the lytic principle (bacteriophage) to mercuric chloride. G. PROCA. *Compt. rend. soc. biol.* **96**, 1244-6(1927).—The lytic principle is very strongly resistant to the action of HgCl_2 .

L. W. RIGGS

Utilization of sugars by *Spirochaeta duttoni*. R. BRUVNOCHE AND A. DUBOIS. *Compt. rend. soc. biol.* **96**, 1403-4(1927).—Expts with mice proved that glucose or other sugar is indispensable to the metabolism and to the activity of spirochetes.

L. W. RIGGS

Decomposition of fats by tubercle bacilli. A. SÉDYCH AND G. SELIBER. *Compt.*

rend. soc. biol. 97, 57-8(1927).—The bacilli were grown in ordinary media to which 4% of olive oil or butter had been added. Tests were also made by adding 0.8 g. of palmitic or stearic acid and 0.2 g. of glycerol per 50 cc. of nutrient medium. The results proved that the bacilli consume both fats and mixts. of acid and glycerol. The bacilli were grown on ordinary agar to which cod-liver oil had been added, and in a mineral medium with the addn. of beef tallow or beeswax. In the latter instance the bacilli developed around the surfaces of the solid fat or wax.

L. W. RIGGS

Centrifuging filtrable viruses. M. S. MARSHALL. *Science* 66, 219(1927).—From an application of Stokes law to the conditions of a virus particle 0.1μ in diam. suspended in a liquid of d. 1.0 and viscosity 0.01, and located 20 cm. from the center of the centrifuge, a speed of 3600 r. p. m. would require 8.8 hrs. of centrifuging to carry the particle 5 cm. Ordinarily centrifuge methods applied to filtrable viruses are, from the standpoint of phys. laws, of questionable value.

L. W. RIGGS

Further studies on the role of organic salts and phosphates in the cultures of *Aspergillus niger*. TETSU SAKAMURA. *Japn. J. Botany* 3, 245-65(1927).—The earlier work (*C. A.* 19, 2512) is confirmed; the org. salts and phosphates serve mainly as buffers and play little part in the nutrition of the *Aspergillus niger*.

C. J. WEST

Acids formed by *Rhizopus* species. TEIZO TAKAHASHI AND TOSHINOBU ASAI. *Proc. Imp. Acad. (Japan)* 3, 86-9(1927).—The culture solus. of *Rhizopus* contg. gluconic acid, after being kept several weeks at 25-30°, contained AcOH, HCO₂H, EtOH, fumaric and succinic acids. Thus gluconic acid is the intermediate product between glucose and these acids. From the culture of (AcO)₂Ca at 25-30° for 60 days succinic acid was isolated.

C. J. WEST

D—BOTANY

B. M. DUGGAR

Jute seeds. *Corchorus capsularis*. I. N. K. SEN. *Quart. J. Indian Chem. Soc.* 4, 205 8(1927).—The seeds contain moisture 7.1, ash 6 and fixed oil 14.73%. Pressure does not sep. the oil but extn. with ligroin does. The characteristics of the oil are d., 0.921, viscosity at 28° (water = 1) 53.1417, n_D^{20} 1.4705, optical rotation 0.0, sapon value 184.4, I value (Wij) 109.2, acid value 24.07, unsapon. matter 3.0%. The oil is insol. in H₂O, EtOH, AcOH, dil. H₂SO₄ and dil. HNO₃, but readily sol. in Et₂O, C₆H₆, CCl₄, AmOH and C₂H₅N. Reactions occur in the presence of Na₂CO₃, HNO₃, Br₂ water, KMnO₄ and Na. The residue of the seeds after the oil was removed was extd. with EtOH. A white gum-like substance, a glucoside, which darkens in air was obtained. The gum does not reduce Fehling soln., but it hydrolyzes in mineral acids to produce glucose and a second substance insol. in water. The glucoside shrinks at 98°, decomposes at 105°, and shows a dextro rotation of 103.6°. Its partial analysis is C 31.16, H 9.65.

F. E. BROWN

The water saturation of plants and its importance in plant growth. HEINRICH WALTER. *Z. Pflanzenernähr. Düngung* A6, 65-88(1925); *Chem. Zentr.* 1926, I, 1876.—The known phenomena of the conservation of org. substances by drying were investigated, and particularly the relation between the relative vapor pressure and bacteria and mold growth. It was found that org. substances no longer become moldy when the relative vapor pressure does not exceed 80% at their surface. A simple process for detg. the relative vapor pressure is described, which is simpler than a detn. of the osmotic pressure. A table shows the min. humidity necessary for the growth of mold fungi and bacteria, from which it is seen that mold fungi begin to grow at 85% and bacteria around 95% humidity. The formation and growth of known types of mold fungi and their antagonism to sugar and salt solns. are also described. In connection with a compilation of earlier works, the importance of the condition of water satn. of higher plants is discussed, and it is considered that in practice in many cases it is more important to provide water than fertilizers. A deficiency of water of but a few per cent, though not necessarily visible in its effects, may nevertheless cause internal damage to the plants.

C. C. DAVIS

An investigation of the occurrence and causes of the phenomena designated by the term "Urbarmachungskrankheit." W. S. SMITH. *Dissertation*, 149 pp., 20 plates. Summary in German. H. Veenman & Sons, Wageningen, Holland, 1927.—Investigations were carried out on the nature and causes of the pathol. symptoms in plants designated by the name "Urbarmachungskrankheit." Pot expts. were conducted with 11 "sick" soils, using oats and peas; in general the symptoms agreed in all cases, while frost injury could not be the cause. Bacteria were eliminated as a cause; the usual sterilization of the soil had no effect. The popular idea that the disease is associated

with a certain type of black moor ("Gliecke") was confirmed; admixt. of this material with normal sandy soil induced the usual symptoms. By extn. of the "Gliecke" with hot alc. 2 types of org. substances were isolate 1, 1 fraction pptg. on cooling of the alc. and 1 remaining in soln. From the latter a crst. substance was isolate 1 which is fairly volatile at 100° and which is called "ghedne". A few mg. of this substance applied to soil growing healthy pea or oat plants caused the disease to appear; in very low concns. it had a stimulating effect. The fraction pptd. on cooling of the alc. caused the symptoms of "gray spot" disease in oats. The effect was studied on various "sick" soils of applications of sand, CaCO_3 , compost, stable manure, CuSO_4 , MnSO_4 , KMnO_4 , ZnSO_4 , MgSO_4 and FeSO_4 . Only compost and CuSO_4 had any remedial effect. The latter was most effective in applications of 50-100 kg per hectare, depending on the intensity of the disease and also probably on the humus content of the soil. The beneficial effects of the compost and CuSO_4 continued during the 2nd yr. Since an org. substance slowly distg. at 100° appeared to be involved, expts. were carried out in which "sick" soils were heated for 3 hrs. on 3 different days in a steam sterilizer. A slightly "sick" soil was completely restored, a moderately "sick" one was almost entirely restored, while a very "sick" soil showed the symptoms only after some time. Sterilized, as well as ashed and ignited, compost was as effective as the untreated material, hence the effect cannot be ascribed to bacteria, but must be due to org. constituents. The titration curves of the "sick" soils did not differ from those of normal ones. Evidence is submitted that the favorable effect of CuSO_4 is due to the formation of an insol. compd. of Cu and the org. substance "ghedne" which causes the "Urbarmachungs" disease.

P. R. DAWSON.

Photosynthesis with ammonia. DEAN BURK. *J. Phys. Chem.* **31**, 1338-51 (1927).—About 500 photosynthesis expts. involving NH_3 and various carbonaceous substances, including CO_2 , HCOOH , HCHO , and glucose, were performed in the attempt (1) to induce NH_3 to build up complex biochem. N compds., (2) to reduce CO_2 , bicarbonates and carbonates, (3) to oxidize NH_3 to hydroxylamine, nitrites and nitrates. Sunlight, condensed through 12-in. lenses, in combination with colored inorg. catalysts was used. Particular attention was paid to purity of materials, control of light intensity and wave length, avoidance of contamination by org. matter, and methods of analysis. Only one type of photochem. change with NH_3 was observed, in the presence of FeCl_3 , NH_3 was oxidized to nitrates; in the presence of ZnO and HgO to nitrites and nitrates. Hydroxylamine was never produced. No photochem. reduction of CO_2 was observed. No complex biochem. N compds. were produced from NH_3 and carbonaceous substances. The results are not in accordance with the positive photosynthesis results of Moore and of Dhar and Sanyal (cf. *C. A.* **20**, 2346).

R. L. DODGE.

Temperature coefficient of absorption in seeds of corn. C. A. SHULL AND S. P. SHULL. *Bokun. Gaz.* **77**, 262-79 (1924); *Physiol. Abstracts* **11**, 573. —The results obtained were similar to those from the study of *Xanthium* seeds and pea cotyledons. The same formulas applied. The temp. coeff. for 5° to 50° was about 1.537. The rate of absorption at 50° was about 8 times that at 5°, whereas chem. theory would call for a rate 32 times as great. Irregular absorptions were also noted, which suggest that some substances have sp. absorption behavior.

H. G.

The ether-soluble substances of cabbage leaf cytoplasm. III. The fatty acids. A. C. CHIBNALL AND H. J. CHANNON. *Biochem. J.* **21**, 479-83 (1927); cf. *C. A.* **21**, 2489. —The fraction of the ext. not pptd. from ether by acetone contains the fatty acids which are not in complex combination in P-contg. substances. The fatty acids shown to be present in this fraction are linolenic, linolic, palmitic and stearic. B. H.

Wheat. A study of the influence of heredity and environment. F. T. SHURR. *Rept. Agr. Canada, Rept. Dominion Chemist*, March 1926, pp. 62-70 (1927); cf. *C. A.* **20**, 434. —The effect of different environmental conditions on the compn. of wheat and on the character of the grain of the same variety is being investigated. Data on the wt. per 1000 kernels, and the H_2O , N and ash content are tabulated for 165 samples representing 45 varieties grown on 18 farms and stations of the Exptl. Farm System throughout the Dominion of Canada during 1924. The av. protein content of the Marquis and Garnet varieties was 16.46 and 15.78%, resp., the former without exception giving the heavier wt. per 1000 kernels. One sample of Marquis wheat grown on irrigated land contained 14.54% protein and 2 samples of the same variety grown on unirrigated land in the same district contained 18.66 and 19.42%. Detailed analyses of flours made from Marquis and Garnet wheats grown at one station in 1925 showed close agreement in the chem. compn. Preliminary expts. showed that wheat grown on summer-fallowed land had practically the same protein content, 13.76%, as the parent

seed, but wheat grown on sweet-clover sod and after sunflowers contained 12.64 and 11.72%, resp. The protein content of barley, grain and straw following timothy was appreciably less than that of barley following meadow fescue, Kentucky bluegrass, bromo and western rye. These investigations are being continued. K. D. J.

The photosynthesis of naturally occurring compounds. I. The action of ultra-violet light on carbonic acid. E. C. C. BALY, J. B. DAVIES, M. R. JOHNSON AND H. SHANASSY. *Proc Roy Soc (London)* 116, 197-211 (1927), cf. *C. A.* 16, 3463; 17, 1923. The view previously advanced (*C. A.* 15, 3072) that the photosynthesis of carbohydrates from carbonic acid takes place in two steps is incorrect. The carbonic acid mol., activated by light, is converted into O and activated HCHO, which then polymerizes into the reducing sugars. Ordinary HCHO is not a component of the photochem. compd. crystallized when an aq. soln. of carbonic acid in quartz tubes is exposed to ultra violet light. The org. compd. present is probably a complex aldehyde. Attempts to effect the photosynthesis of the carbohydrates by adding a harmless reducing agent to the carbonic acid soln., in the hope of shifting the equil. to the carbohydrate side by the removal of O, were successful in only one case. $\text{Fe}(\text{HCO}_3)_2$ in aq. soln. is converted by ultra violet light in the absence of O into $\text{Fe}(\text{OH})_3$. At the same time org. compds. with reducing properties are formed, but the yields are very small. When an mol. of powder, capable of adsorbing carbonic acid on its surface, is suspended in H_2O through which a stream of CO_2 is passed, and the whole is exposed to ultra violet light, complex org. compds. are photosynthesized. Effective powders are Al powder, BaSO_4 , freshly pptd. $\text{Al}(\text{OH})_3$, and the basic carbonates of Al, Mg and Zn. The total quantity of org. compd. produced is about 0.02 g. in 2 hrs., when 8 quartz test tubes, 9 in. \times 1 in., contg. 720 cc. H_2O and the suspended powder, are exposed to the light from a 220-volt U-shaped lamp at an av. distance of 6 cm. The org. compds. produced seem to be complex carbohydrates. They char readily when heated alone or with concd. H_2SO_4 . After hydrolysis with HCl, the soln. in most cases reduces Benedict's soln. **II. The photosynthesis of carbohydrates from carbonic acid by means of visible light.** E. C. C. BALY, W. E. STEPHEN AND N. R. HOOD. *Ibid.* 212-9. Photosynthesis of org. compds. takes place when carbonic acid, adsorbed on the surface of NiCO_3 or CoCO_3 suspended in H_2O , is exposed to visible light. To obtain the best yields of org. matter the suspended carbonate must be in the form of a fine powder and free from every trace of alkali. One of the products is a carbohydrate which reduces Benedict's soln., gives the Mohr and Hübner reactions and forms a solid osazone. The reducing power of the photosynthesized compd. is increased on hydrolysis by HCl, indicating the presence of complex carbohydrates of higher mol. wt. than the hexoses. The O set free during the photosynthesis tends to poison the surface by the formation of oxides. The surface slowly recovers under H_2O , so that increased yields of carbohydrates are obtained with unit quantity of light when the intensity of illumination is decreased. When the surface has become completely poisoned, the photosynthetic process ceases and then with intense illumination the carbohydrates previously formed are photochemically decomposed. **III. Photosynthesis in vivo and in vitro.** E. C. C. BALY AND J. B. DAVIES. *Ibid.* 219-26.—In this paper B and D. summarize the features common to photosynthesis *in vivo* and *in vitro*. LOUISE KELLEY

The globulins of rice, *Oryza sativa*. D. BREESE JONES AND C. E. F. GERSDORFF. *J. Biol. Chem.* 74, 415-26 (1927).—By dialyzing saline exts. of white rice a protein fraction was isolated which contained 2 globulins coagulating at 74° and 90°, resp., which were sepd. by fractional coagulation. The elementary compn. of the 2 varied and is, resp. C 52.83, 49.15; H 6.77, 7.86; N 16.31, 17.94; S 0.98, 1.45; ash 0.29, 1.64%. The following percents of certain amino acids were found in the 2 globulins: cystine 2.25, 2.89; arginine 7.85, 15.18; histidine 2.42, 3.01; lysine 7.14, 3.63; tryptophan 2.69, 2.32; tyrosine 5.60, 7.53. The fractions coagulating at 74° and 90° amounted to 0.09 and 0.07% of the flour, resp. A. P. LOTHROP

Studies on glutelins. II. The glutelin of rice (*Oryza sativa*). D. BREESE JONES AND F. A. CSONKA. *J. Biol. Chem.* 74, 427-31 (1927); cf. *C. A.* 21, 2718.—In contrast with wheat endosperm, polished rice contains but one glutelin. This is pptd. from an 0.2% NaOH ext. by 0.03 satn. with $(\text{NH}_4)_2\text{SO}_4$. Its isoelec. point is at p_H 6.45. It contains 11.13% of arginine, 2.39 of histidine, 4.73 of lysine and 2.35 of cystine and has the following % compn.: C 52.58, H 6.42, N 17.57, S 1.65, P trace, ash 0.384. A. P. LOTHROP

Variation of protein content of corn. V. H. B. ARBUCKLE AND O. J. THIES, JR. *J. Elisha Mitchell Sci. Soc.* 42, 113-7 (1926); cf. *C. A.* 20, 62.—A résumé of the previous papers is given. Immature corn is low in protein. Grains from the middle of the ears

are higher in protein than those from the butt or tip. Nitrates apparently increase and phosphates decrease the percentage of protein slightly. Climate and soil expts. gave varying results leading to no definite conclusions. A. L. MEHRING

Studies in the physiology of fruit trees. I. The seasonal starch content and cambial activity in one to five year-old apple branches. THOMAS SWARBRICK. *J. Pomology Hort. Sci.* 6, 137-56(1927).—A marked disappearance of starch from the cortex and phloem occurred in Jan with a reappearance late in Feb., followed in May by complete disappearance from all tissues of 1-4-yr. old branches. These changes occurred later in the 4-yr. than in the 4-yr. old branches. When elongation growth slowed down starch accumulation began in the cortex and xylem. In vegetative shoots cambial activity began early and the starch disappeared later, but in flowering shoots the reverse was true. Thirty-two citations are appended. A. L. MEHRING

Comment on L. Jost's paper, "The potential differences of the apple." I. MICHARLIS. *Biochem. Z.* 185, 113(1927); cf. *C. A.* 21, 2293. S. MORGULIS

Phytochemical reduction. GÜNTER NAGELSCHMIDT. *Biochem. Z.* 186, 317-21(1927).—The reduction of diacetyl takes place through the formation of acetoin. S. MORGULIS

Effect of age on the composition of the wood of maritime pine. M. H. PATY. *Chimie et industrie* 18, 204-10(1927).—Analyses are given of wood from trees of different ages and from trees that had been tapped and trees that had not. Pentosans first increase to a max. of about 10%, reached at about 5 yrs. of age, and then slowly decrease with age. Methylpentosans vary similarly. Lignin shows a const. but very slow increase with age (4% in 50 yrs.), the rate of lignification being slightly greater in young wood and tending to a limit below 35%. Total and α -cellulose increase fairly rapidly up to about 20 yrs., and more slowly thereafter, tending to limits below 60 and 40%, resp. β - and γ -Celluloses vary irregularly with increase in age, the max. of the curves increasing with age, those for γ -cellulose being higher than those for β -cellulose; the max variations are about equal in both cases (3-4%). Needles and young shoots have relatively high pentosan and low lignin and cellulose contents. Oleoresins increase slightly with age, but not above 2%. Ash varies but little, remaining in the neighborhood of 0.5%. Tapping considerably increases the oleoresin content. Recent tapping of the trees appreciably reduces the pentosan and total and α -cellulose contents and slightly reduces the β - and γ -cellulose, but not the lignin; as the duration of tapping increases, so does the reduction in pentosans and total cellulose, lignin also decreases, while γ -cellulose increases. This may be explained as follows. The growth of the trees continues during tapping, but it utilizes a greater proportion of its nourishment to elaborate the cicatrizing fluid (oleoresin), thereby reducing the relative proportion of the other tissues. Freshly cut wood has slightly higher total and α -cellulose and methylpentosan contents and lower pentosan and lignin contents than wood of the same age which has been cut two years. A. P.-C.

The role of phosphate in plant respiration. C. J. LYON. *Am. J. Botany* 14, 274-83(1927).—P exerts a promoter action upon potato oxidase, so that CO_2 is produced by an oxidation of some component in a soln. of glucose. P catalyzes the slow oxidation of pyrogallol and of tannic acid by atm. O, and increases the rate of production of CO_2 by anaerobic processes because of its role in the early stages of alc. fermentation. It causes an increase in the production of CO_2 by the aerobic phase of respiration through its action as a catalyst toward oxidases. This promoter action is equally pronounced when the enzymes are contained within the cells of such plants as *Elodea canadensis* or wheat seedlings. Arsenic also exhibits this catalytic property which is partly masked by its toxic effect. J. J. SKINNER

The hydron concentration of plant tissues. III. The tissues of *Helianthus annuus*. S. H. MARTIN. *Protoplasma* 1, 497-521(1927); cf. *C. A.* 21, 2721.—The sunflower (*Helianthus annuus*) was studied at all stages in the life history of the plant from the seed to the matured flowering plant. The reactions were obtained by noting the behavior of the various tissues toward suitable indicators, as shown by section. No distinct gradient of reaction for the different regions was observed, except in various tissues above and below the ground. The epidermal hairs gave a reaction of pH 9-10. All other reactions were on the acid side. **IV. The buffer of sunflower hypocotyl.** *Ibid.* 522-36.—The expressed sap of sunflower hypocotyl was on the alk. side of the isoelec. point of most plant proteins and as a negligible amt. of protein was present in the sap, attention was directed to the phosphate system as accounting for the buffering action of the sap. The inorg.-phosphate content in the expressed sap varied between 0.005 M and 0.007 M H_2PO_4 . The buffer values of the sap in terms of M H_2PO_4 corresponded very closely to the actual phosphate concns. The normal reactions of the

sap were therefore only slightly buffered, and the small amt. of buffer action was due to the correspondingly low concn. of inorg. phosphate in the sap. An atm. of CO_2 ranging from 5% upward changed the normal reaction p_{H} 5.6 to reactions of higher acidity. Below 5% the CO_2 did not affect the p_{H} of the sap within a range of 0.2 while above 5% a progressive series of reactions of decreasing p_{H} values was obtained with increasing concns. of CO_2 . **V. The tissues of *Vicia faba*.** M. W. REA AND V. SMALL. *Ibid* 2, 45-58(1927).—It was early demonstrated that the sunflower and the broad bean differed considerably in the differentiation of their tissues with regard to H-ion concn. The outstanding feature of the sunflower was the marked acidity of the epidermis which characteristic was absent from the broad bean. In the present investigation the tissues of *Vicia faba*, both white and green varieties, were examd. throughout the plant and at various stages in the life of the plant. A comparison of the tissue reactions of *Vicia faba* and *Helianthus annuus* was made. M. H. SOULE

Effects of correlation between vegetative and reproductive functions in the tomato (*Lycopersicon esculentum* Mill). A. E. MURNEEK. *Plant Physiology* 1, 3-56(1926).—The analytical data and growth records of M.'s comprehensive expts. on the tomato plant grown in sand and soil cultures indicate that vegetative growth is regulated or controlled by the fruit, which is able to monopolize almost all the available nitrogenous food supply. The rate of growth declines at the exact time and in inverse proportion to the amount of fruit set and developing. Suggestions are given as to the possible mechanism operating to produce the correlation between the reproductive and vegetative functions. WALTER THOMAS

The extraction of plant tissue fluids and their utility in physiological studies. R. NEWTON, W. R. BROWN AND W. M. MARTIN. *Plant Physiology* 1, 57-65(1926).—The tissue fluids from finely ground plant material are obtained by means of an hydraulic press. The operations are carried out close to 0° . Standardization of the extn. procedure, especially with regard to the use of low pressure, is shown to be essential in order that fluids obtained may be substantially of the same compn. as the original tissue fluids. The analysis of the fluids obtained in this way, supplemented by the ordinary chem. analysis of plant tissues, affords a convenient method of obtaining the distribution of any constituent between the physiologically active and inert portions of the plant. WALTER THOMAS

Studies on the oxygen-supplying power of the soil together with quantitative observations on the oxygen-supplying power requisite for seed germination. I. M. HUTCHINS. *Plant Physiology* 1, 95-150(1926); cf. *C. A.* 17, 3737.—The present paper describes in detail the standardization of an improved form of the earlier app. It affords an exceedingly sensitive and practical method for the exptl. study of the dynamics of the soil-oxygen aspect of ecology and agriculture. The principle of the method remains unchanged. Previous findings of the oxygen-supplying power of the soil for a plant root were corroborated. In addn. expts. were conducted on the O-supplying power requisite for germination of wheat, maize and rice seeds. Each kind of seed appears to have its own min. O requirement. The O-supplying power requirement for seed germination is in accord with what might have been expected, viz., that this requirement is not the same for all kinds of seeds. Some germinate well with exceedingly slow O supply while others require a very rapid supply of O. With the improved app. actual values or rates (expressed in mg. per sq. m. per hr.) of the supplying power index of the medium can be detd. H. pleads for the dynamic as opposed to the static concept of problems relating to soil aeration and of the oxygen needs of germinating seeds. WALTER THOMAS

Nutritional studies on *Fusarium lini*. I. Preliminary studies of some sugars and some nitrogen sources. E. S. REYNOLDS. *Plant Physiology* 1, 151-64(1926).—Fermi's culture medium with the glycerol replaced by sugars in concns. 0.25-0.05 M was used. The nutritional value of the sugars is in the following descending order: glucose > maltose > sucrose > levulose > xylose > arabinose > mannose > galactose. The nutritional value of the N compds. tested for this fungus are in the descending order: $\text{KNO}_3 > \text{Ca}(\text{NO}_3)_2 > \text{NH}_4\text{C}_2\text{H}_3\text{O}_2 > (\text{NH}_4)_2\text{HPO}_4 > \text{C}_6\text{H}_5(\text{NH}_2) \begin{smallmatrix} \text{COOH} \\ \text{CONH}_2 \end{smallmatrix} > \text{KNO}_2 > (\text{NH}_4)_2\text{SO}_4 > \text{CO}(\text{NH}_2)_2$. $\text{Ca}(\text{NO}_3)_2$ gave no growth. **II. Effects of flax extracts on *Fusarium lini*.** Using Fermi's culture medium R. found that the aq. ext. from a "resistant" strain of flax depressed the growth of the flax wilt-fungus more than the ext. from a "susceptible" strain. The same type of exts. when autoclaved accelerated growth; hence the factor causing depression in growth is a relatively labile or volatile compd., probably the glucoside linamarin. Inasmuch as R. has previously shown (*C. A.* 18, 2218) that concns. of KCN of 0.03 M and higher prevented the development

of fungus, it is suggested that the relatively higher quantity of the glucoside found in the resistant strain may offer an explanation of immunity to flax wilt-fungus. W. T.

Adsorption as a means of determining relative hardness in the apple. STUART DUNN AND A. L. BAKKE. *Plant Physiology* 1, 165-75(1926) — Good correlation was found between the adsorptive power of malachite green from soln. by pulverized tissues of apple twigs and the hardness of the varieties from which the samples were taken. The expts. were conducted on the cambium, cortical and other non woody tissues, which were able to pass through a 100 mesh screen, the wooly portions remaining behind. It is suggested that the hydrophylic colloids prevent death from the dehydrating force of freezing by their power to hold water within the cell. W. T.

A study of the clearing of alcoholic plant extracts. W. E. LOOMIS. *Plant Physiology* 1, 179-89(1926) — Consistent results can be obtained by taking up the alc.-free residues with warm water. After cooling to room temp. sufficient $Pb(OAc)_2$ soln. (d. 1.25) is added to form a faint, white ppt. with a drop of dil. $K_2C_2O_4$ soln. Twice this quantity is used for clearing the soln. to be tested, to insure pptn. of reducing impurities. The soln. should not stand for more than a few min. and is then filtered on to an excess of $K_2C_2O_4$ crystals or powder. Heating or standing in contact with a lead soln. causes a rapid destruction of reducing substances. Basic lead acetate is more destructive than the neutral salt and gives a variable loss even in cold solns., the magnitude of which depends upon the completeness of clearing. The degree of completeness of clearing does not affect the purity of the CuO ppt. However, as in cases where a plant ext. or a mixt. of ext. and sugar soln. was used, the percentage of Cu has been approx. 87% instead of the theoretical 88.8%. The explanation for these results is not apparent. WALTER THOMAS

The adaptation of certain colorimetric methods to the estimation of nitrates, phosphates and potassium in plant solutions. B. E. GILBERT. *Plant Physiology* 1, 191-9(1926) — The results of the analysis of tissue juices from corn, turnips, celery, beets, spinach and lettuce grown with different quantities of manure are recorded to show that the detn. of the sol. nutrients of fresh plant juices affords a more valuable method for establishing the optimum nutrient levels of the 3 principal fertilizer "elements." The tissue juices are obtained by grinding the fresh tissue in a Nixtanal mill and straining through fine-mesh silk. The analyses are carried out by slight modifications of well known methods, *viz.*, the phenoldisulfonic acid method for nitrate N, ceruric-molybdate for phosphate phosphorus, and the reduced chloroplatinate method for K. WALTER THOMAS

The mechanism of accumulation of dyes by living cells. G. W. SCARFF. *Plant Physiology* 1, 215-29(1926) — In all cases studied, basic dyes, when they accumulate in much higher concn. in the sap than outside, are held less strongly than acid dyes. (a) *Basic dyes.* — The exact mode of combination varies in different cells, but the common feature is that the dye may combine with a colloid having lipid properties and be stored simply in virtue of this combination. The affinity of this colloidal material for basic dyes is greatest when the pH of the sap is between 5 and 6. The colloidal material behaves as an ampholyte and its other phys. properties suggest that it is partly hydrated lipid, enveloped probably by a mono- or bi-mol. film. (b) *Acid dyes.* — While the ability of the normally basophil colloidal material to take up acid dyes when the sap is acidified points to the possibility of their adsorption in the cell, the actual mechanism of storage by the cells of *Anthurium* which normally accumulate such dyes remains undecided. WALTER THOMAS

Some chemical changes incident to ripening and storage in the Grimes apple. FISK GERHARDT. *Plant Physiology* 1, 251-64(1926); cf. *C. A.* 20, 3310. — The analytical work was carried out on the vacuum-dried, finely ground material, which was freed from lipoids and sol. org. acids. The analytical results indicate that (1) The ripening processes both on the tree and in storage are assoc. with loss of moisture, acidity, dextrins, starch and acid hydrolyzable material, together with an increase in sp. gr., sugars and sol. pectin. (2) The time of picking or condition of maturity has little influence on the ultimate compn. of the apples under investigation. (3) The production of apple scald tends to decrease with increase in maturity of the fruit. (4) There seems to exist an interrelationship between the relative amt. of total sugars in each individual picking of the fruit prior to cold storage and production of breakdown tissue, but with this exception, there appears to be no correlation between chem. compn. and keeping quality of cold-storage apples. It is suggested that phys. or chem. changes not detd. are involved in the formation of unfavorable tissue during storage. W. T.

Growth studies on fruits. F. G. GUSTAFSON. *Plant Physiology* 1, 265-72(1926). — The plotted growth measurements of fruits of *Cucurbita Pepo* var. *condensa*, *Cucumis*

Melo, *C. sativus* and *Lycopersicum esculentum* give the typical S-shaped curve. The agreement of the observed values with the values calcd. from the equation $x/(A-x) = K(t-t_1)$, where A represents the final size reached, x the size after time t and t_1 , the time at which half the size is reached (cf. *C. A.* 18, 1142), is fairly close except in the early phase. G., therefore, believes that the monomol. autocatalytic reaction interpretation of growth rates (cf. *C. A.* 18, 1142) is not entirely satisfactory. W. T.

Plant growth-promoting substances, hydrogen-ion concentration and the reproduction of Lemna. N. A. CLARK. *Plant Physiology* 1, 273-9(1926).—*Lemna major* grew and reproduced indefinitely in culture solns. of purified inorganic salts without the addn. of org. matter, both in daylight and under elec. light. The reproduction const. K was calcd. from the equation $\log N - \log N_0 = K(t-t_0)$ (cf. *C. A.* 20, 1427). Daily changes of the culture medium increased the rate of reproduction of the plants by keeping the H-ion concn. more uniform and diminishing the amt. of bacterial growth. When this latter influence was reduced as low as possible by using a frequently changed culture medium that had been boiled and afterward made up to the original concn. with sterile water, the plants still made good growth. The optimum p_H probably varies with the compn. of the culture soln. WALTER THOMAS

E—NUTRITION

PHILIP B. HAWK

Influence of surface-active substances on the fungus growths in thrush in respect to water-soluble vitamins. F. V. VON HAHN. *Kolloid-Z.* 40, 321-7(1926).—A study of the physico chem. conditions for the mycelial formation of the thrush revealed no difference between the natural vitamin-rich products and artificial solns. of high surface activity. This supports the view that the vitaminoid state is essentially characterized by a certain surface tension. B. C. A.

Blood counts in vitamin-A deficiency disease with especial reference to the platelets. E. H. FALCONER AND GLYNDON PEACHEY. *Am. J. Physiol.* 76, 145-50(1926).—Av. blood counts on 24 rats in various stages of vitamin-A deficiency showed 204,000 less platelets, 137,000 more red cells and 2300 more white cells than normal. It is concluded that these changes are not striking enough to constitute a sp. lesion of vitamin-A deficiency. J. B. BROWN

The resting metabolism of infant rats in relation to temperature control. ADDISON GELICK. *Am. J. Physiol.* 76, 206(1926).—Well conditioned rats in the first few days of life produce 7-9 cal. per kg. at 16°, 24° or 31°. In starved rats 2 days old the rate at 20° is less than half that at 30°. This basal metabolism is perhaps close to the physiol. limit of heat production in a relaxed organism. J. B. BROWN

Statistics of nutrition. IV. Statistics of the action of foodstuffs. L. BERCELLER AND H. WASTL. *Wiener med. Wochschr.* 77, 637-10(1927).—A review. A. G.

The sensitiveness of animals nourished with vitamin-free food to poisons in contrast to normally nourished and to fasting animals. II. Poisons and fasting. G. VERCELLANA. *Ann. igiene* 35, 860-4(1925); cf. *Ann. igiene* 35, 785.—The expts. showed that, in general, fasting animals are less sensitive to poisons than those on a vitamin free diet. This is attributed to the fact that fasting animals are weakened, while those on a vitamin-free diet become diseased. **III. The behavior of normally nourished rabbits, of rabbits fed exclusively on autoclaved oats and of fasting rabbits towards atropine.** *Ibid.* 953-9; *Chem. Zentr.* 1926, II, 59.—The expts. showed that rabbits fed exclusively with autoclaved oats lose their natural resistance toward atropine, in contrast to fasting animals, which retain it. Transfusion of the blood of normally nourished or of fasting animals to those on a vitamin-free diet restores the resistance of the latter to atropine. C. C. DAVIS

Recent work on the nutrition of the pig. J. B. ORR AND ARTHUR CRICHTON. *Trans. Highland and Agr. Soc. Scotland* [5], 39, 25-41(1927).—A review with bibliography. K. D. JACOB

Changes in the organism by cod-liver oil added to the food. ERIK AGDUHR. *La pædiatr.* 6, 165-79(1926); *Ber. ges. Physiol. expil. Physiol.* 40, 524.—Description of clinical symptoms and pathol. changes of blood and organs caused in rabbits, rats, doves, pigs, cats and dogs and particularly in white mice by prolonged oral or parenteral administration of large doses of cod-liver oil. The toxicity is somewhat diminished by simultaneous administration of vitamins B and C. The toxic substance has not been isolated. MARY JACOBSEN

Investigations concerning the photoactivity of certain oils, with special reference to their effect as antirachitics. EIGIL REKLING. *Acta radiol.* 5, 517-52(1926); *Ber.*

ges. *Physiol. expil. Pharmacol.* **40**, 177.—Photoactivity does not run parallel with antirachitic potency. Cod-liver oil is photoactive in its native condition. Linseed and olive oils acquire activity through irradiation in the presence of O_2 . The latter is indispensable. A current of air removes the acquired photoactivity but not that of cod-liver oil. *Conclusion*: The acquired photoactivity is detd. by the H_2 content of the oil, or by the Russel effect.

MARY JACOBSEN

Basal metabolism in vitamin B starvation. SEIZABURO OKADA, EIICHI SAKURAI, TSUKIO IBUKI AND HARUTOSHI KAHN-SHIMU. *Arch. Internal Med.* **40**, 292-313(1927).—Vitamin B starvation aggravates beriberi and produces in normal subjects a typical avitaminosis. In both cases the basal metabolism is lowered. Vitamin B raises the metabolic rate and effects improvement and cure, resp. The identification of beriberi with B-avitaminosis is opposed by a difference in many factors. Basal metabolism is normal in the former, lowered in the latter. In beriberi it increases with threatening decompensation and decreases in the presence of paralysis and atrophy. Whether the difference in metabolic rate may serve as a means of differentiation must be established by further expts.

MARY JACOBSEN

Changes in the kidney in animals with increased blood pressures while on high protein diets. F. R. NUZUM. *Arch. Internal Med.* **40**, 364-76(1927).—The urine of rabbits fed 24 months on liver and oats was acid and frequently contained casts and albumin. The nonprotein and urea N of the blood was increased, the CO_2 of the plasma lowered, systolic blood raised. A soy-bean diet caused an excessively alk. urine. There was clinical evidence of kidney injury which was possibly caused by the acidity or alk. of the urine passed by the animals during $\frac{1}{2}$ of their natural lives. M. J.

Comparative study of hunger and vitamin B starvation in the same subject. E. MIYAKE. *Folia endocrinol. japon.* **2**, 704-31(1926), *Ber. ges. Physiol. expil. Pharmacol.* **40**, 381. Blood gases, effect of adrenaline, N excretion and clinical symptoms were observed in a man receiving a vitamin B deficient diet before and after a hunger period of several weeks. Hunger reduces vitamin B consumption. The onset of avitaminosis is pptd. by a preceding period of hunger. The symptoms of B-avitaminosis are detd. by the carbohydrate rather than by the vitamin content of the deficient diet. The symptoms of hunger and vitamin B deficiency are altogether different. M. JACOBSEN

Utilization of the calcium of spinach. LAURA McLAUGHLIN. *J. Biol. Chem.* **74**, 455-62(1927).—Spinach, fed for 6 days as the only food high in Ca in a diet consisting of some of the most commonly used foods, produced distinctly positive Ca balances in 6 out of 7 healthy women and Ca equil. in the 7th. Spinach furnished 70% of the Ca and the intake was greater than the calcd. requirement for maintenance. It was thought that the repeated use of an unusually large quantity of spinach would emphasize any tendency toward hindrance to Ca assimilation through the presence of fiber or oxalates, but no such tendency was demonstrated. Storage of Ca in adult women is assumed to demonstrate a utilization of the Ca of spinach.

A. P. LOTHROP

The metabolism of sulfur. XIII. The effect of elementary sulfur on the growth of the young white rat. GEORGE T. LEWIS AND HOWARD B. LEWIS. *J. Biol. Chem.* **74**, 515-23(1927), cf. *C. A.* **21**, 3071. Flowers of S in concns of 0.08, 0.50, 0.75 and 1% were fed to young white rats maintained on 2 types of cystine-deficient diets, the Sherman-Merrill milk powder-starch diet and the Osborne-Mendel diet. The cystine requirements for growth were in no way altered and S cannot replace cystine in the diet. The addn. of 1% of S to the milk powder-starch diet caused the death of 14 out of 22 animals and thus was definitely toxic, the effect probably being due to H_2S formation in the intestine. Retardation of growth was observed when 1% of S was added to the Osborne-Mendel diet and with lesser concns. in the Sherman-Merrill diet. The toxicity was not affected by the presence of cystine in the diet.

A. P. LOTHROP

Influence of fat and carbohydrate diets upon the level of blood uric acid. V. J. HARDING, KATHLEEN D. ALLIN AND B. A. EAGLES. *J. Biol. Chem.* **74**, 631-43(1927); cf. *C. A.* **19**, 1292. The increase in blood uric acid observed on high fat diets is correlated with decreased excretion. Low protein-high carbohydrate diets of mixed origin fail to raise the level of blood uric acid in the normal puerperium. Similar diets showed raised blood uric acid in the puerperium following toxemia.

A. P. LOTHROP

The antirachitic value of irradiated cholesterol and phytosterol. VIII. The activation of sterol fractions by ultra-violet irradiation. A. F. HESS AND R. J. ANDERSON. *J. Biol. Chem.* **74**, 651-7(1927), cf. *C. A.* **21**, 100.— α -Sitosterol is strongly antirachitic after activation by ultra-violet light while β - and γ -sitosterols are inactive. As the latter 2 substances are purified by bromination, any antirachitic substance which might be present in these less sol. sterol fractions is destroyed in the purification. It cannot be definitely stated whether traces of ergosterol are present in corn oil and is the sub-

stance in the α -sitosterol which is activated. "If ergosterol is the sole antirachitic precursor, it is evident that this sterol must be universally present in all fats of animal and of plant origin that are capable of activation by ultra-violet light. This is an exceedingly broad conception. Considerable further chem. and biol. investigations will be necessary before it can be decided whether certain sterols other than ergosterol can contribute to the antirachitic activity of irradiated material." A. P. LOTHROP

Vitamin A content of milk. J. BIRGER PLATON. *Biochem. Z.* 185, 238-41 (1927).—A comparison of the vitamin A content of milk with an av. fat content of 2.8 and 0.18% shows that 1.75-2.0 cc. of either is required for normal increase in wt. The expts. are not conclusive, but suggest that the vitamin A is combined with other constituents of the milk than fat only to a negligible extent. S. MORGULIS

Edible holothuria. SIGMUND FRÄNKEL AND CURT JELLINEK. *Biochem. Z.* 185, 389-91 (1927).—The protein of edible holothuria is nearly completely digested by pepsin, the N being almost entirely reduced to amino acid N. S. MORGULIS

Specific dynamic action of foodstuffs. VI. Specific dynamic action and carbohydrate metabolism. I. ABELIN AND B. KOBORI. *Biochem. Z.* 186, 3-27 (1927).—The sp. dynamic action is regarded to be assocd. with the formation of carbohydrate. Experimentally produced disturbances of the carbohydrate metabolism (feeding of thyroid, tyramine, phenylethylamine, adrenaline, etc.) lead to an increase in the basal metabolism and at the same time of the sp. dynamic action. Studies on the influence of phlorhizin show that following repeated injections the sp. dynamic action of meat generally is much increased, which is interpreted as being due to the greater demand for carbohydrate and to the enhanced formation of this from the protein. S. M.

The influence of food composition, especially its amino acid content, on the urinary C:N quotient. A. BICKEL AND I. REMEZOV. *Biochem. Z.* 186, 54-63 (1927).—If the protein of the food is partially replaced by an equiv. amt. of N in the form of amino acid, the C and N absorption in the intestine is improved but the oxidation of the protein is not increased. The N is retained while the unoxidized C in the urine is greater so that the C:N quotient increases. S. MORGULIS

Further studies on the influence of feeding active ferric oxide on metabolism with special reference to the nitrogen balance and the behavior of the urinary C:N quotient. IGOR REMESOV. *Biochem. Z.* 186, 64-86 (1927).—Baudisch's active Fe_2O_3 produces in dogs a retention of N due to a diminished protein oxidation in the intermediate metabolism and to an improved utilization of the food in the intestine. It likewise influences the fat and carbohydrate metabolism. S. MORGULIS

The different behavior of pigeons and chickens when their vitamin-B need is supplied in the form of fresh green vegetables. ARTHUR SCHEUNERT AND MARTIN SCHENBLICH. *Biochem. Z.* 186, 222-8 (1927).—Pigeons require much greater quantities of fresh green vegetables to supply their need for the antineuritic factor, and cannot therefore be used as exptl. animals in testing the vitamin-B content of such foodstuffs because of their inability to consume a sufficiency of them. S. MORGULIS

Further studies on the vitamin content of beer. ARTHUR SCHEUNERT AND MARTIN SCHENBLICH. *Biochem. Z.* 186, 229-31 (1927).—The vitamin-B content of dark beer prepd. from rye seedlings is very small just as was found to be the case also in porter beer. S. MORGULIS

The volatile fatty acids formed in the preparation of acid feed. II. C. BRAHM. *Biochem. Z.* 186, 232-41 (1927); cf. *C. A.* 19, 2714. S. MORGULIS

Demonstration of the antirachitic factor of grasses grown in the dark and under window glass. W. VOLTZ AND W. KIRSCH. *Biochem. Z.* 186, 255-63 (1927).—The seeds of the grass *Lolium perenne* do not contain any antirachitic substance. The seedlings of the same possess antirachitic properties when they are grown under window glass or in complete darkness. These results argue against the assumption that the antirachitic factor is formed through the radiation of a provitamin (ergosterol). S. MORGULIS

Studies on fat and lipid metabolism. IV. The role of the reticuloendothelial system in fat and lipid metabolism. SAMUEL LEITES. *Biochem. Z.* 186, 391-412 (1927); cf. *C. A.* 21, 2296.—Intravenous injection of colloidal Ag, Fe, India ink suspension or olive-oil emulsions causes a lowering of the cholesterol content in the peripheral blood of dogs which manifests itself within 10 min. after the injection. After 2 hrs. the normal content is restored. The loading of the dog with olive oil, olive oil and cholesterol, or olive oil and lecithin *per os*, causes less lipemia or cholesterolemia after a preliminary blocking of the reticulo-endothelial system than without such blocking. Following a mild blocking, loading the dog with fat *per os* causes the cholesterol content of the blood from the hepatic and femoral veins to be lower than in the arteries while

in the v. linealis the neutral fat content is less than in the artery. With strong blocking, the neutral fat content of the v. linealis and femoralis is greater than in the artery while the cholesterol content remains unchanged. The blood cholesterol is lowered through blocking even in the hypocholesterolemic condition resulting from splenectomy. Intravenous injection of Na oleate after preliminary blocking causes a rise in cholesterol in the femoral vein. Conclusion: The reticulo-endothelial system of the spleen, liver and bone marrow plays a part in the elimination of neutral fat and cholesterol from the blood as well as in the general processes of fat metabolism. The mild blocking of this system increases its absorption ability for neutral fat in the bone marrow, and for cholesterol in the liver and bone marrow. With more extensive blocking, the absorption of neutral fat diminishes while that of cholesterol is unaffected. At the same time the function of the reticulo-endothelial system of the bone marrow and spleen of converting cholesterol into neutral fat, and of the liver and bone marrow of the building of cholesterol from fatty acids is increased. V. The role of the spleen in fat and lipid metabolism. *Ibid* 436-50.—Following splenectomy in dogs the bound cholesterol and lipid P of the blood increase for a period not exceeding 6 months. Loading splenectomized dogs *per os* with olive oil or olive oil and cholesterol leads to a much greater hypercholesterolemia than before splenectomy, but this is not a regular occurrence. Intravenous injection of olive oil emulsion causes an increase in the neutral fat of the blood which is not observed before splenectomy. Splenectomized dogs, unlike normal dogs, show no lowering of the neutral fat and rise in cholesterol of the hepatic vein blood as a result of loading. Likewise, the arterial blood fails to show marked changes in cholesterol. The increased alimentary hyperphemia of splenectomized dogs is obviously due to the absence of an organ where the elimination of neutral fat takes place as well as to the disturbance of neutral fat elimination and cleavage in the liver. The increased alimentary hypercholesterolemia of splenectomized dogs is due to the diminished elimination of endogenous cholesterol which normally occurs in the spleen, and to the greater cholesterol content of arterial blood and lungs. S. M.

The biochemical relation between the condition of the organism, nutrition and the resistance of red blood cells. GYOZO PETRANYI. *Biochem. Z.* 186, 419-35(1927).—There is a definite correlation between the resistance of the blood cells and the general condition of the organism, which increases with loss of body wt. and diminishes with gain in wt. Food consumption likewise increases the resistance, the greatest influence being exerted by protein and fat foodstuffs. S. MORGULIS

Vitamin C in fresh grass (*Lolium perenne*; English Rye grass) and the weight of various organs in scurvy. E. BROUWER. *Biochem. Z.* 187, 183-93(1927); cf. *C. A.* 20, 2693. Fresh grass is rich in vitamin C during all seasons of the year. A g. of fresh grass per day protected guinea pigs for months against scurvy. Hay is very poor in vitamin C. Preservation of grass in silos likewise caused destruction of the vitamin. In scorbutic animals granules of Fe are deposited in the spleen, adrenals, intestine and liver. A comparison of the wt. of different organs from normal and sick animals shows a striking diminution of the thymus and increase of the adrenals in scurvy. The wt. of the eye and kidney is unaltered, that of the spleen shows great variability from animal to animal, while the wt. of all other organs is less in the animals suffering scurvy. S. MORGULIS

Biochemistry of iodine. STEFAN WEISER AND ARTHUR ZAITSCHEK. *Biochem. Z.* 187, 377-81(1927). I₂ in food had no effect on the duration of pregnancy, but a much larger per cent of the new born pigs had reached maturity without any intercurrent diseases. Likewise, the pigs nursed by sows receiving I₂ attained a much greater body wt. at the time of weaning (13.17 and 18.54 kg. on the av. for the young of animals fed without and with the addn. of I₂). The amt. of milk secreted was apparently not affected by the presence or absence of I₂ in the food. S. MORGULIS

Contribution to the knowledge of the fate of isopropyl alcohol in the human organism. HIKMET KEMAL. *Biochem. Z.* 187, 461-6(1927). Isopropyl alcohol is partly eliminated from the human body as acetone in the urine and expired air. In the urine the acetone appears within the first hr. and can be still quantitatively demonstrated even after 48 hrs. In the breath the acetone appears within 15 min. The acetone in the urine could be demonstrated even with 0.25 g. of isopropyl alc., but the acetone represents a small fraction of the ingested isopropyl alc. The quantity could be increased up to 100 mg. by liberal consumption of liquids. When the isopropyl alc. was taken in several small quantities the acetone elimination in the urine was reduced. No diacetic acid was found. S. MORGULIS

Vitamins and the canned foods industry. A. PELLERIN. *Chimie et industrie* 18, 211-5(1927).—A discussion of the effect of pH, heat, O, drying and aging on vitamins

showing that canned foods subjected to modern sterilizing processes retain a considerable proportion of their vitamins.

A. PAPINEAU-COUTURE

Is the formation of sterols connected with the metabolism of fats? E. F. TERROINE, R. BONNET, G. KOPP AND J. VECHOT. *Bull. soc. chim. biol.* 9, 678 91(1927).—The parallelism observed by Terroine, in various species of animals, between the content of aliphatic acids and sterols, does not exist in the seeds of flax, castor-oil plant, soy bean, peas, peanut and sorghum. The cholesterol content of muscle and liver in animals which have been fattened by abundant rations is the same as that in normal subjects of the same species. In microorganisms naturally rich in fat or caused to produce fat by being grown in a disequilibrated medium rich in glucose, there is no parallelism between the content of aliphatic acids and sterols. These facts do not support the hypothesis of a simultaneous synthesis of neutral fats and sterols. In the course of germination of oily seeds the disappearance of fats corresponds to an increase of phytosterol more marked in light than in darkness. In the bean, pea and sorghum the disappearance of fats is accompanied by a diminution, or no change, in the phytosterol. *Sterigmatocystis nigra* grown on various fats has a higher content of sterol than if grown on glucose or peptone. This indicates a formation of sterols at the expense of the fats.

L. W. RIGGS

Comparative studies on the content of glutathione of certain tissues and blood of the normal pigeon, the underfed pigeon and the pigeon deprived of vitamin B. (MME.) L. RANDOIN AND RENÉ FABRE. *Compt. rend.* 185, 151 3(1927).—Expts were made with 40 pigeons divided into appropriate groups. In adult normal pigeons the skeletal muscles contain an av. of 26 mg. of glutathione per 100 g. of fresh tissue, heart 30, liver 140 and the blood 61. In the underfed pigeon a marked diminution of glutathione occurred in the muscles but was slight in the other tissues. In the pigeon deprived of vitamin B there was little or no change in the glutathione content during the first period of pre-mortal temps. In the second period there is a diminution of glutathione in the skeletal muscles which reaches about 10 mg. per 100 g. at the crisis. The diminution is much less in the other tissues. During the period of deprivation of vitamin B there appears to be an increase of reducing substances other than those which contain the SH group.

L. W. RIGGS

Variations in the iron content of the liver, spleen and blood under the influence of a regimen disequilibrated by a complete removal of the antiscorbutic vitamin. (MME.) L. RANDOIN AND (Mlle.) A. MICHAUX. *Compt. rend.* 185, 365-8(1927); cf. C. A. 21, 1139. A first lot of 25 guinea pigs was fed a complete artificial ration commonly used, and a second lot of 25 received the same ration deprived of vitamin C. The Fe content of the spleen averaged practically the same for each lot, while the Fe content of the liver was diminished so that by the 20th day it was about $\frac{1}{4}$ the normal figure. The Fe content of the blood diminishes slightly during the scurvy.

L. W. RIGGS

Different extracts of yeast and their content of vitamin D compared with the initial proportion of vitamin in the fresh yeast. CASIMIR FUNK AND RAOUL LECCO. *Compt. rend. soc. biol.* 97, 440-2(1927); cf. C. A. 17, 129, 3043. —With either beer or distillery yeast, extd. by the method of Harris or by 70% alc., the quantity of vitamin D in the exts. remains proportionally the same as in the fresh yeast used. The proportion of vitamin D does not appear to be connected with the antineuritic factor or the water-sol growth-promoting factor.

L. W. RIGGS

Antirachitic activity of irradiated cholesterol, ergosterol and allied substances. A. E. HESS. *J. Am. Med. Assoc.* 89, 337 9(1927), cf. C. A. 20, 2187. —Expts. in feeding rats with a rickets-producing ration and various irradiated foods led to the following conclusions: The most practical application of an irradiated food is the use of irradiated dried milk for infant feeding. This food prevents or cures infantile rickets and tetany, and maintains its sp. activity for at least 6 months. Irradiated cholesterol and irradiated dried brain were used successfully. The activity of irradiated cholesterol is due probably to a contaminating sterol. Ergosterol prepd. from yeast brought about calcification of the epiphyses when as little as 0.002 mg. was fed daily. This is the smallest quantity of any vitamin which was found to exert a sp. action. Irradiated yeast is highly effective as an antirachitic in animals and in infants.

L. W. RIGGS

Treatment of pernicious anemia by a special diet. G. R. MINOT AND W. P. MURPHY. *J. Am. Med. Assoc.* 87, 470 6(1926); *Expt. Sta. Record* 56, 294. —A diet composed of foods rich in complete protein and iron, particularly liver, and contg. an abundance of fruits and fresh vegetables and very little fat, was given to a series of 45 patients with pernicious anemia for periods varying from 6 weeks to 2.5 years, with promising results in prompt remission of the anemia, rapid increase in the red blood corpuscles and hemoglobin count, and improvement in clinical appearance.

L. W. R.

A diet rich in liver in the treatment of pernicious anemia. G. R. MINOR AND WM. P. MURPHY. *J. Am. Med. Assoc.* 89, 759-66(1927).—A study of 105 cases treated from 3 months to 3 years with a diet rich in marshallian liver (200 \pm g. cooked wt. daily) shows that this diet can benefit essentially all patients with this disease. The improvement is usually rapid and striking, and there is a marked and prompt increase of the red blood corpuscles in almost every case. Symptomatic improvement is pronounced. A few g. per day of a non-protein fraction of the liver produces a prompt temporary increase of reticulocytes, causing a rapid rise of the red blood corpuscles, and appears to benefit the patient in the same manner as whole liver. In all cases the patient must take an adequate and well balanced diet. L. W. RIGGS

Maintenance requirements of cattle on different rations and at different rates of production; with a note on "dynamic action." JAMES WILSON. *Sci. Proc. Roy. Dublin Soc.* 18, 399-406(1927).—A discussion of work by Armisby and by Kellner. L. W. RIGGS

Microbiological investigation as to the extent to which rice has been polished. P. J. TEDING VAN BERKHOUT. *Mededel. Dienst Volksgezondheid Nederland-Indië* 1926, Pt. 4, 489-502.—The expts. indicate it may be possible to det. the extent to which rice has been polished by detg. the influence of rice ext. on yeast growth or glucose fermentation. GEORGE ERIC SIMPSON

Nutrition and cell function. V. Psychic behavior of rats fed upon different diets. EMIL ANDERHALDEN AND ERNST WERTHEIMER. *Arch. ges. Physiol. (Pflüger's)* 216, 396-401(1927); cf. *C. A.* 20, 3489.—When rats had been fed for a considerable period on a diet rich in protein and poor in carbohydrate their behavior differed definitely from that of control rats which had received an abundance of carbohydrate, in that their spontaneous activity and susceptibility to fright was increased. The rats which had received high protein were more resistant to alc. than were those on the high carbohydrate diet. G. H. S.

Metabolism in the hedgehog and mole. FRANCE GROEBBELS. *Arch. ges. Physiol. (Pflüger's)* 213, 407-18(1926).—The hedgehog awakened from hibernation and placed in an av. external temp. reacts with an intense and gradual increase in O utilization with a corresponding production of heat. In the awakening process glycogen is consumed primarily, later fat is burned. The respiratory rate varies with the heat production. As compared with the hedgehog the mole exhibits a poor chem. heat regulation, heat production resulting only from muscular activity or because of the sp. dynamic power of its food. Normally the mole first utilizes glycogen, but when deprived of food, fat is consumed. G. H. S.

A study of colostrum with special reference to the effect of heat (pasteurization) on its physico-chemical, bacteriological, immunological and nutritional changes. A. C. RAGSDALE, SAMUEL BRODY AND C. W. WEBER. *Missouri Agr. Expt. Sta., Bull.* 236, 46-7(1926).—A study was made of calves in the dairy and beef cattle herds in order to det. the "normal" mortality rate. The mortality rate was also detd. for calves fed their mother's pasteurized colostrum and also raw wholemilk and egg white and milk emulsion as substitutes for colostrum. The growth of *B. coli* in colostrum and colostrum substitutes was also detd. E. F. SNYDER

The causes of vitamin destruction in cooked and canned foods. HANNAH A. STILLMAN. *Missouri Agr. Expt. Sta., Bull.* 236, 63-4(1926).—Oxidation was studied as a cause of vitamin C destruction. Exhausting cans and using minimum head space should tend to preserve vitamin C. E. F. SNYDER

Mineral and vitamin requirements of pigs, with special reference to the effect of diet on bone development. G. BOUSTEY, W. L. ROBINSON, R. M. BETHKE AND B. H. EDGINGTON. *Ohio Agr. Expt. Sta., Bull.* 395, 59-229(1926).—The basal ration used, or a ration composed of grains and seeds or their products, is too low in certain vitamins as well as both the quantity and quality of the ash to permit normal growth and continued health. For the proper development of the animals the basal ration appeared to contain vitamins A and D in too limited amts. The addn. of yeast, fed either dry or left to ferment the feed in a moist condition, made no appreciable difference in the effects of the ration. Vitamin B, therefore, does not play a significant role. The first 3 expts. showed rather conclusively that the proteins and fiber in the basal ration of white corn, wheat middlings, linseed meal, and salt were not prominent factors in the problem of so-called stiffness in pigs. An immediate cause of posterior paralysis was found to be fractured vertebrae in the lumbar-sacral region of the spinal column. Ground limestone was consistently the most effective single addn. to the basal ration. Green grass in addn. to the consumption of soil and the basal ration made for most rapid gains and best health judging from external appearances. Bone fractures were common

in pigs fed cod-liver oil with the basal ration, unless some Ca salt was fed with the ration. Alfalfa meal or cod-liver oil in the ration accounted for a relatively high inorg. P content of the blood serum. The best growing pigs had the highest blood P, and the poorest ones the lowest. Com. blood meal fed with the basal ration hurried pigs into stiffness and paralysis. Fish meal and tankage both caused fairly rapid growth and good bone.

E. F. SNYDER

The antirachitic value of human milk. H. J. GERSTENBERGER, J. I. HARTMEN AND D. N. SMITH. *California and Western Med.* 27, 40-4(1927).—Human milk from mothers receiving 1 tablespoonful of cod-liver oil daily in addn. to a good general diet possessed no antirachitic properties when fed to 3 cases of active non-healing rickets for periods up to 36 days. Antirachitic properties were shown on the 20th and 32nd days of feeding by human milk from mothers exposed to artificially produced actinic rays.

R. C. WILLSON

The vitamin value of some common foodstuffs. W. H. EDDY. *N. Y. State J. Med.* 27, 170-2(1927); cf. *C. A.* 20, 1432.—With the aid of guinea pigs on the Sherman-LaMer basal diet, vitamin A, B and C values for various fresh and canned, raw and cooked vegetables and fruits were detd. Values are expressed in percentages of standards.

R. C. WILLSON

The value of butter in the diet. C. U. MOORE. *Northwest Med.* 26, 29-30(1927).—When vegetable fats are substituted for butter in the diet of rats and puppies, their growth is stunted. Vegetable fats cause a deficiency in calcification resulting in greater fragility of the bones together with increased transparency to x rays. Clinical experiences indicate that children respond in a similar way.

R. C. WILLSON

F—PHYSIOLOGY

E. K. MARSHALL, JR.

Histologic studies on the fat content of the normal human thyroid. R. H. JAFFÉ. *Arch. Path. Lab. Med.* 3, 955-62(1927).—The lipid droplets found in the epithelium of the thyroid gland in human beings are the products of the secretory activity of these cells. According to their staining reactions, they consist mainly of mists of phospholipins. They are discharged into the colloid secretion of the thyroid gland where they are dissolved gradually. The excretion of the lipins starts after the first year of life and increases with age. Diseases do not seem to have any influence on the intensity of the lipid excretion. In 45% of the thyroid glands distinct staining of the plasma of the smaller blood vessels with Sudan III was observed, suggesting that the blood that circulates about the vesicles is rich in fat. Both clinical and exptl. data are available which, in accordance with the microscopic observations, point toward some relation between the fat metabolism and the function of the thyroid.

HARRIET F. HOLMES

The method for graphic determination of the total gaseous exchange in man during muscular activity. J. G. DUSSEER DE BARENNE AND G. C. E. BURGER. *Proc. Acad. Sci. Amsterdam* 29, 1075-80(1926); cf. *C. A.* 19, 88, 679, 1873.—The method previously described by the authors is applied to the detn. of the total gaseous exchange in man before, during and after muscular activity.

DAVID DAVIDSON

The sugar metabolism of the nervous system. HANS WINTERSTEIN. *Sitzb. Abhandl. naturforsch. Ges. Rostock* 1, 7-12(1925-6).—In the resting state, a loss of glycogen occurs in the isolated surviving central nervous system of the frog, which is greater than that occurring during elec. stimulation. The addn. of sugar to the surrounding medium has no appreciable influence unless insulin is added, when extensive synthesis of glycogen and cerebroside takes place. The simultaneous action of insulin, sugar and elec. stimulation greatly enhances this synthesis so that the carbohydrate content may exceed that of the fresh prepn.

DAVID DAVIDSON

New investigations of the nitrogen exchange of the central nervous organs. HANS WINTERSTEIN. *Sitzb. Abhandl. naturforsch. Ges. Rostock* 1, 13-4(1925-6); cf. *C. A.* 20, 365.—The nitrogenous substances given off to the surrounding medium by the surviving isolated central nervous system of the frog in the resting state consist of NH_3 and protein (few %), N titratable by CH_2O and water-sol. lipoids (28-9%) and N of unknown origin (about 25%). When stimulated by the elec. current the ammonia and protein N remain unchanged, the lipid N increases somewhat, while the N titratable by CH_2O and that of unknown origin are increased several times. The addn. of glucose affects N economy, particularly during stimulation, when all of the effect may be borne by the sugar. Sick animals show an increased protein excretion and a greatly

increased metabolism under stimulation Narcosis diminishes the N exchange to undetectable limits.

DAVID DAVIDSON

Historical development and conquests of biochemical methods in physiology. A. CLEMENTI. *Arch. farmacol. sper.* **43**, 129-41(1927).—An address, introductory to a course in human physiology at the Univ. of Catania.

A. W. DOX

Preliminary communication on the excretion of kynurenic acid in the bile. Y. KOTAKE AND K. ICHIHARA. *Z. physiol. Chem.* **169**, 1-2(1927).—After subcutaneous injection of 2.0 g. tryptophan in a dog with biliary fistula, 0.061 g. kynurenic acid was recovered from the bile and 0.3572 g. from the urine in 24 hrs. In a 2nd expt. 0.2327 g. was isolated from the bile and 0.1842 g. from the urine. The excretion of kynurenic acid in the bile now explains the wide variations often observed in the urinary excretion of this acid after administration of tryptophan.

A. W. DOX

The relationship of the hydrogen ion to the genesis of the cardiac rhythm. E. P. CARTER AND E. COWLES ANDRUS. *J. Clin. Investigation (Proc.)* **2**, 599(1926).—The effect of p_{H} changes of the fluid bathing the isolated heart on the origin and spread of the excitatory process was studied. It is suggested that the rate of origin and propagation of this process is dependent upon the difference of $[\text{H}^+]$ within and without the cardiac cells.

ARTHUR GROLLMAN

A study of red blood cell permeability. J. P. PETERS, A. J. EISENMAN AND A. M. WAKEMAN. *J. Clin. Investigation (Proc.)* **2**, 603-4(1926).—The distribution of base between human blood cells and serum after the addition of NaCl, KCl, Na_2CO_3 and K_2CO_3 was determined. Whether equimolar amounts of Na or K were added, the changes in distribution of H_2O , Cl and CO_2 were quantitatively identical and hence there was no evidence of any change in distribution of base between cell and serum.

ARTHUR GROLLMAN

The carbon dioxide equilibrium in alveolar air and arterial blood during exercise. A. V. BOCK, D. B. DILL, J. S. LAWRENCE AND L. M. HURXTHAL. *J. Clin. Investigation (Proc.)* **2**, 604(1926).—By a modification of the Haldane Priestley method for obtaining samples of alveolar CO_2 during exercise, a close agreement between the CO_2 tension in the alveoli and arterial blood was demonstrated.

A. G.

Energy used in "sprint" running. K. FURUSAWA, A. V. HILL AND J. L. PARKINSON. *Proc. Roy. Soc. (London)* **B102**, 43-50(1927).—Upon comparison of the mechanical work done in sprint running against the viscous resistance of the muscles with the O_2 consumption during recovery from the effort, the mechanical efficiency was found to be approximately 38%. In a 200-yard sprint, the maximum velocity attained was 11.46 yards per sec. with an energy output of 8.5 horse power, and a lactic acid production in the muscles of more than 4 g. per sec.

JOSEPH S. HEPBURN

Occurrence of the estrus cycle after x-ray sterilization. IV. Irradiation of the adult during pregnancy and lactation, and general summary. A. S. PARKES. *Proc. Roy. Soc. (London)* **B102**, 51-62(1927); cf. *C. A.* **21**, 2934.—The periodicity of estrus apparently is due to the periodic attainment of a threshold value by estrin. The synchronization of ovulation and estrus is probably due to a common stimulus.

JOSEPH S. HEPBURN

Experiments concerning the question of secretion of phenolsulfonephthalein by the renal tubule. A. N. RICHARDS AND J. B. BARNWELL. *Proc. Roy. Soc. (London)* **B102**, 72-91(1927).—Phenol red, applied to the decapsulated kidney (rabbit or frog), passes into the urine eliminated by it. When NaCl solution is made to flow from the ureter through the tubule to Bowman's capsule, while the renal portal system is perfused with phenol red solution, that dye can be identified in the liquid collected from the capsule. Even when circulation through the glomerulus is completely obstructed, phenol red enters the tubule and becomes concentrated there. On immersion of an excised frog kidney in oxygenated phenol red solution, the dye passes into the tubule and becomes concentrated. This apparent secretion of phenol red by the tubule cells is best explained by (1) diffusion of dye and water into the tubule at one level, (2) active extrusion of water and retention of dye at another level, and (3) a fluid current within the tubule from the one level to the other. This explanation is supported by the action of cyanides. When cyanides are used to abolish the vitality of the tubule cells, they also abolish the power of the excised kidney to concentrate phenol red within its tubules, but do not prevent entrance of the dye into the tubules; they also abolish the power of the tubules to retain phenol red, and stop the fluid current, which can otherwise be demonstrated by noting the progressive changes in the distribution of C or a colloidal dye injected into the tubule.

JOSEPH S. HEPBURN

Coagulation of hemoglobin in the presence of alcohols. II. B. JIRGENSONS. *Kolloid-Z.* **42**, 59-65(1927); cf. *C. A.* **21**, 2924.—The coagulation of hemoglobin in the

presence of varying concns. of MeOH, EtOH and PrOH and of $MgCl_2$ and $CaCl_2$ has been studied in order to det. the relations between alc. and salt concns. and coagulation. In the presence of 0.0033 M $CaCl_2$ all 3 alcs. sensitize the coagulation in all concns. up to 60% alc. At higher salt concns. (0.5–1.0 M) EtOH and PrOH exert stabilizing effects. MeOH sensitizes the coagulation under all conditions investigated. EtOH sensitizes the coagulation at all alc. concns. when only small quantities of $MgCl_2$ or $CaCl_2$ are present; at higher salt concns. EtOH has a stabilizing action when it itself is present in large amts. The lower concn. limits for the stabilizing action are approx. 0.2 M $CaCl_2$ and 63% alc. PrOH acts similar to EtOH; the lower concn. limits for the stabilizing effect are 0.2 M $CaCl_2$ and 53% alc. At lower salt concns. larger concns. of EtOH and PrOH are necessary to stabilize the hemoglobin soln.; as the salt concn. is increased less alc. is necessary. A large amt. of tabulated data is given and the results are shown graphically. C. D. INGERSOLL.

The storage of water by various tissues of the body. HAROLD SKELTON. *Arch. Internal Med.* 40, 140–52 (1927).—The distribution of water in man, in the rat, dog, cat and rabbit is tabulated. The muscles contain 50, the skin 25, the blood 7% (plasma 67, corpuscles 33%) of the water. The effects of hemorrhage, dehydration, fasting and injections of distil. water, hypo-, iso- and hypertonic NaCl and 1.2 and 1.4% $CaCl_2$ are described in detail. Conclusion: Muscle is the main water depot. It loses the least amt. of water per g. tissue, gives up the most fluid in hydration and takes up the greatest portion of the water added. The skin is second in importance as a water reserve. Changes of water content affect the liver and intestines first. The response of the various tissues to a change of water content, especially following hemorrhage or injections of distil. water or hypotonic NaCl, is in agreement with Starling's interpretation of capillary permeability. MARY JACOBSEN.

Fat embolism. Experimental studies. DINO VANUCCI AND PIERO FRANCESCHINI. *Arch. ital. chir.* 16, 585–681 (1926). II. Considerations on the fate of fat introduced into circulation. PIERO FRANCESCHINI AND DINO VANUCCI. *Scritti biol.* 1926, 163–88; *Ber. ges. Physiol. expil. Pharmacol.* 40, 648–9. MARY JACOBSEN.

Muscle contracture and rigidity. FIL. BOTTAZZI. *Arch. sci. biol. (Italy)* 8, 417–447 (1926).—When gradually heated in Ringer soln. or a paraffin oil bath contg. O_2 the striated amphibian muscle shows a shortening called heat contracture (I) at 35–40°, a 2nd contraction or heat rigidity (II) at 42–6° and a terminal contracture (III) at 51–60°. In the diaphragm muscle of the dog I occurs at 45° (slight precursor at 20°), II at 50°, III at 63–7°. I is reversible; II and III are not. III also takes place in dead muscle and is apparently caused by changes in connective tissue. The effect of low temps. discussed. The contracture of freezing occurs in striated and heart muscle of cold- and warm-blooded animals, but never in smooth muscle. Lactic acid is considered a prerequisite of its production. Muscles desiccated in air are capable only of III. $CHCl_3$ has the same effect, but mammalian muscle may be able to perform I and II if the exposure was but short. Moderate work, especially when carried out in an O_2 -free bath, lowers the temp. of I to 30° (lactic acid). Addn. of lactic acid has no effect on amphibian muscle up to 27°. On gradual heating a contraction begins at 30°, increases slowly toward 60° and ends in a sudden rupture of the muscle at 61° caused by the conversion of collagen to gelatin. Mammalian muscle shows in the presence of lactic acid a slow contraction at 30° resembling death rigor, which becomes more rapid at 37° to 40°. III occurs at 45°. Caffeine and to a lesser degree nicotine lower the temp. of contraction (I at 25°, II at 45°). Acetylcholine and novocaine have no effect; apparently they do not cause the formation of lactic acid. Veratrine causes contractures which are by far less intense than I and II and does not hasten the heat contractures. M. J.

Muscle tonus. A review. FIL. BOTTAZZI. *Arch. sci. biol. (Italy)* 8, 480–506 (1926).—A discussion of the current views on the contractile muscle elements, stimulation and the mechanism of contraction, the latter in connection with the theories of imbeddation, surface tension and gelification. B. has advanced the view that both fibrillae and sarcoplasm are contractile. The former contract rapidly and intermittently, the latter slowly and continuously. Under physiol. conditions both function jointly, even if not simultaneously. The physiol. tetanic contraction of striated muscle is the sum total of fibrillary contractions supported by sarcoplasm contraction. Normal tonus, partial muscle function, the contractures of decerebration, heat, cold, veratrine and nicotine depend chiefly on the function of the sarcoplasm. Since both tonic contractions and contractures occur *in vivo* without the intervention of poisons or abnormal tonus it is necessary to assume twofold innervation: one acting chiefly or exclusively on the fibrillae, the other on the sarcoplasm. Double (sympathetic and somatic) innervation could be eventually dispensed with. Somatic innervation alone, either with

twofold excitation depending on a different condition of nerves and substrate to which the stimulus is carried, or with a different stimulus conduction in each medium would satisfactorily account for the phenomena. B agrees with Cobb that convincing evidence of sympathetic muscle innervation has not been produced. MARY JACOBSEN

Spleen and carbohydrate metabolism. V. Glycogen formation. A. NOMA. *Okayama Igakkai Zasshi* 1926, 1185 1213. *Ber. ges. Physiol. exptl. Pharmacol.* 40, 384.—Glycogen formation, hyperglucemia and glucosurias are not affected by splenectomy. MARY JACOBSEN

The problem of calcium fixation in the body. C. SERONO. *Rass. clin., terap. sci. affini* 26, 123-7(1927).—The absorption and fixation of Ca and Mg in the body are detd. by org. phosphatides, which in their turn are fixed by cholesterol. An energetic metabolism produces enough CO₂ to maintain a sufficient concn of Ca and Mg in the body fluids. With progressing age production of phosphatides and basal metabolism slow down while the absorption of cholesterol, chiefly from the food, is not materially lowered. This leads to hypercholesterolemia and calcification of tissues. These degenerative changes of old age also appear in children under pathological conditions. The sluggish metabolism results in CO₂ deficiency and alkalosis followed by the pptn. of Ca and tetany. The convulsions of insulin overdosage are of the same origin (the hypoglucemia causing a decrease of blood CO₂). Similar metabolic disturbances occur in protracted diseases, such as tuberculosis, syphilis and malaria. In spite of their different origins the same treatment is recommended for rickets and the cachexia resulting from the above diseases: thyroid-parathyroid, combined with Ca and a diet rich in cholesterol or cholesterol injections. For hemorrhages, tetany and eclampsia 5% Ca lactate is recommended. Unlike all other Ca salts and gelatin it is painless on injection. For recalcification Ca₃(PO₄)₂ or Ca phospholactate is used in doses not over 1-2 g. Addn. of 8-10% Mg is recommended. MARY JACOBSEN

Physico-chemical theory of nerve functioning. P. LAZAREV. *Riv. biol.* 8, 638-57 (1926); *Ber. ges. Physiol. exptl. Pharmacol.* 40, 715.—The excitation of nerves or sense organs is brought about by local changes in ion concn. For details see the original. The cond. of a visual red soln. increases on exposure to light and decreases again in the dark, the changes following the law of a monomol. reaction. MARY JACOBSEN

Reinjection of blood of the same organism. III. Modification of stability of blood suspensions by the injection of own and heterogeneous red cells. G. DI MACCO. *Riv. patol. sper* 2, 29-36(1926); *Ber. ges. Physiol. exptl. Pharmacol.* 40, 694.—The injection of the animal's own and of beef erythrocytes had the same effect. The sedimentation velocity was diminished even 1 hr. after injection. Viscosity and n were slightly lowered, the surface tension was slightly increased. The effect is attributed to a decrease in the percentage of serum proteins which in its turn is caused either by an influx of water from the tissues or by a surface action of the injected red cells. MARY JACOBSEN

The surface tension of urine in pregnancy. I. BASILEVIC AND A. JANCENKO. *Ukrainski med. visti* 2, 13-9(1926); *Ber. ges. Physiol. exptl. Pharmacol.* 40, 705.—Out of 202 cases only 21% showed a lowered surface tension (bile salts) of the urine in the 1st 5 months of pregnancy. Urobilin was demonstrable in 30.3%, bilirubin only rarely. In the 2nd half of pregnancy and immediately *post partum* the surface tension was lowered in 60%, urobilin increased in 34%, bilirubin rarely. The results support the view of "pregnancy liver". MARY JACOBSEN

Changes in the human tracheal cartilage under physiological and pathological conditions. HANS NEVINNY. *Z. Konstitutionslehre* 13, 155-98(1927).—Detailed anatomical and histological study. The following chemical changes are discussed: calcification occurred in granular and plaque form. Albumoid degeneration was very frequently, the amyloid one never, encountered. Edema of the cartilage is detd. not only by pathol. body fluids but also by colloidal swelling of the tissue which needs further study. In incomplete involution of the cartilage fatty degeneration of the basic substance was never observed, but there was a strikingly high fat content of the cartilage cells, especially in the intermediate strata. MARY JACOBSEN

Extra-hepatic functions of bile. C. L. A. SCHMIDT. *Physiol. Rev.* 7, 129-50 (1927).—Review and bibliography taking up the role of bile as a reservoir of alkali, its property of activating enzymes and accelerating their action, its emulsifying effect on fat, its functions in regulating the intestinal bacterial flora and promoting intestinal peristalsis, its relation to the action of cathartics and its importance in other biological processes. E. R. LONG

Current views on "internal secretion." SWALE VINCENT. *Physiol. Rev.* 7, 288-319(1927).—Review and bibliography. E. R. LONG

Oxytocic power of the pituitary under different circumstances. C. PAK. *Arch. expl. Path. Pharmacol.* 114, 354-61 (1926).—The oxytocic power of the posterior lobe of the pituitary of the rat was not affected by As, x-rays, thyroid removal and CO poisoning. Diphtheria toxin and Hg poisoning caused a decrease; while elec. stimulation of the sympathetic nerve was followed by an increase. J. F. LYMAN

The antagonism of pituitrin and insulin. G. A. CLARK. *Proc. Physiol. Soc., J. Physiol.* 62, viii (1926).—Previous injection with ergotamine did not abolish the antagonism between pituitrin and insulin contrary to the results of Lawrence and Hewlett (*C. A.* 19, 3113). Pituitrin probably does not act by way of the sympathetic nervous system. J. F. LYMAN

Studies on the biochemistry of menstruation. KAREL KLAUS. *Biochem. Z.* 185, 3-10 (1927).—The blood of menstruating women contains a high choline concn. The choline is eliminated both in the sweat and in the menstrual blood but in either case, especially the latter, it undergoes bacterial decompn. with the liberation of trimethylamine (possibly also of di- and monoaniline), which is responsible for the sp. smell of the secretion during menstruation. S. MORGULIS

The enzymic lactic acid formation in muscle extract. IV. Cleavage of hexosemonophosphoric acid. OTTO MEYERHOF AND KARL LOHMANN. *Biochem. Z.* 185, 113-64 (1927); cf. *C. A.* 21, 2280. —Chemically the natural hexosemonophosphoric ester and the Robison and Newberg esters differ from the synthetic esters by their much greater reducing value (Bertrand method) and by their different aldose content. Unlike the synthetic esters or the hexosediphosphate they are more prone to spontaneous oxidation in phosphate soln., whereby the Newberg ester with a higher ketose content oxidizes 3-4 times as rapidly as the Robison ester and twice as rapidly as fructose. The monoesters are stronger acids than the di-esters, the Newberg and Robison acids having a p_{K_1} of 0.97 and 0.94 and p_{K_2} 6.11; while with the synthetic ester of Hatano $p_{K_1} = 0.61$, $p_{K_2} = 5.83$, and that of Nodzu $p_{K_1} = 0.84$, $p_{K_2} = 5.67$. The natural mono-esters are at first very rapidly hydrolyzed by muscle ext. whereby a part of the lactic acid is decompd. and another part is simultaneously synthesized to hexosediphosphoric acid. The accumulation of Harden-Young's acid is indicated by its rapid cleavage in the presence of arsenate, as well as at 37°, into equiv. amts. of lactic acid and H_3PO_4 . In the presence of F the splitting to lactic acid fails to materialize while the synthesis of the di-ester continues with the absorption of inorg. PO_4 . This cleavage-esterification reaction proceeds in the presence of coenzyme and is as sensitive as the cleavage of polysaccharides. Unlike the Robison or Newberg ester, the synthetic esters are almost as stable in muscle ext. as they also are in phosphate soln. The mono-ester manifests similar behavior in yeast ext. The hypothesis is postulated that the intermediary ester in the nascent state assumed to appear in carbohydrate cleavage by muscle or yeast ext. is a hexosemonophosphoric acid similar to that of Robison or Newberg. S. MORGULIS

Studies on the physiology of glands. LEON ASHER. CV. The influence of meat on the respiratory metabolism of rats fed on fat. A contribution to the physiology of the liver. TATYOSHI HONDA. *Biochem. Z.* 185, 173-91 (1927); cf. *C. A.* 21, 2328. —A one-sided diet of bacon causes a lowering of the basal metabolism of the rat as compared with the metabolism on a mixed diet. The specific-dynamic effect of meat, which has been detd. in rats on a mixed diet, is lost almost entirely when the rats are fed on bacon alone. Since the liver of these animals shows signs of fatty degeneration which progresses in a manner parallel to the loss of the specific-dynamic effect, it is thought that this may be a manifestation of altered liver function. CVI. **Effect of the thymus gland on the sensitivity to lack of oxygen with special reference to the respiratory center.** HANS STAMPFEL. *Ibid* 192-204. —Thyroidectomized guinea pigs behave toward lack of O practically as normal animals. Removal of the spleen makes them for a time much more sensitive to lack of O, which must be ascribed to the onset of thyroid hyperfunction since splenectomy does not cause anemia in the guinea pig. When both thymus and thyroid glands are removed the reaction is markedly different from that of the normal guinea pig because the respiratory center becomes much less sensitive. CVII. **Further studies on the mode of action of specific diuretics. The blocking of the normal reaction through intraperitoneal injection of distilled water.** G. M. CURTIS. *Ibid* 186, 95-111. —Injection of 100 cc. H_2O intraperitoneally practically suppresses the specific diuretic action of ephyllin, but when the intraperitoneal fluid becomes isotonic with the blood and has the same concn. of Cl an injection of ephyllin produces diuresis. CVIII. **Further studies on the mode of action of specific diuretics. The blocking of the normal reaction in rabbits with denervated kidneys.** G. M. CURTIS AND N. F. SCHAMBAUGH. *Ibid* 111-29. —Injection of distd. water into the peritoneal cavity of rabbits with completely denervated kidneys blocks

entirely the vigorous diuresis due to ephyllin. This blocking effect is not caused by a reflex vasoconstriction. Likewise, the increased urine excretion following total denervation of the kidney is inhibited by the presence of the peritoneal exudate. Analyses show that the blocking of the diuresis is caused by the removal of electrolytes from the body into the peritoneal cavity.

S. MORGULIS

The destruction of diacetic acid in the kidney. I. SNAPPER AND A. GRÜNBAUM. *Biochem. Z.* **185**, 223-8 (1927).—When the surviving kidney of the dog or sheep is perfused with blood to which diacetic acid was added only 27–55% of this is found in the kidney and blood. In 6 expts. 68, 67, 73, 52, 45 and 58% of the diacetic acid added (177 to 349 mg. calcd. as acetone) disappeared. Only a small part was changed to β -hydroxybutyric acid (5, 6, 1, 11, 6 and 8% of the added diacetic acid). In the liver, 16–33% of β -hydroxybutyric acid is oxidized to diacetic acid but very little of the added β -hydroxybutyric acid is destroyed. Likewise in the liver 50–60% of added diacetic acid is reduced to β -hydroxybutyric acid and very little is destroyed. The kidney, on the other hand, destroys a large part (29–70%) of the added β -hydroxybutyric acid without a simultaneous oxidation to diacetic acid, and, furthermore, destroys a large part (50–70%) of diacetic acid with only a very small (1–11%) conversion to β -hydroxybutyric acid. These results are only obtained in perfusion expts. with surviving kidneys, but not with the ground-up organ.

S. MORGULIS

The regulation of the hydrogen ion concentration in blood. I. Studies on the changes in potential of blood using the quinhydrone electrode and their theoretical significance. SCHAU-KUANG LIU. *Biochem. Z.* **185**, 242–54 (1927). The H and quinhydrone electrode give a difference of 0.01–0.01 pH. Blood from the left ventricle, dild. 1:4, gives a very regular series of potential changes using the Pt quinhydrone electrode, rising to a max. within the first min., remaining const. for 1–2 min., then slowly dropping off by about 1 milliv. per min. Au electrodes give more const. results.

II. Studies of the effect of solution and saturation of the quinhydrone on the potential changes in blood. *Ibid.* 255–62.—The quinhydrone potential changes of the blood are apparently due to such factors as oxidation-reduction, alteration in red cells, catalysis, etc. III. Studies on the potential changes of serum, plasma, red cell suspensions and hemoglobin solutions using the quinhydrone electrode. *Ibid.* 263–74. Plasma or serum, dild. 1:4, shows a rapid rise in potential which remains const. for 1/2 min. and then gradually declines. Buffered hemoglobin solns. or red cell suspensions give only a negligible alteration of potential.

S. MORGULIS

The behavior of the liver in rarefied air. A. LOEWY. *Biochem. Z.* **185**, 287–319 (1927).—At 250 mm. barometric pressure (corresponding to an altitude of 8500 m.) guinea pigs lose much more in wt. than control animals. In rats the difference was not as pronounced. The effect on the H₂O content of the liver is not definite, and seems to be greatly influenced by the method of killing the exptl. animals. The content of N substances in the liver is less than normal in rats at reduced pressure, and especially low in thyroidectomized rats under such barometric conditions. Furthermore, the non-protein fraction of the total N of the liver is very greatly increased, much more so than fasting alone would occasion. The av. increase in non-protein N of the liver of rats which died under low barometric pressure was 74%. In the thyroidectomized rats this increase was 190% on the av. The ether ext. of the liver is much more increased in guinea pigs than in rats at reduced pressure as compared with the liver fat content under similar conditions but at full atm. pressure. The increase in P content of the ether ext. indicates that the P contg. components of the liver (lipoids) are becoming constantly more sol. The P/N ratio in the liver increases above normal in rats under reduced pressure.

S. MORGULIS

The blood sugar problem. II. The quantity of the non-glucose fraction under different conditions. B. SJÖLÉMA. *Biochem. Z.* **185**, 355–61 (1927); cf. C. A. **21**, 2712.—Disaccharides are sepd. from glucose in blood filtrates by an adsorption reaction with charcoal which in the presence of 0.5% AcOH leaves only glucose in soln. but leaves also the disaccharides dissolved if sufficient ether is added. By this method 3 fractions are distinguished (glucose, disaccharide and non-sugar). In horse blood the total reducing substance for the plasma was 103.6 mg., of which the 3 fractions contained 82, 21.6 and 0 mg.; the corpuscles with a total of 135.9 mg. reducing substance had 64.9, 71 and 0 mg. of the 3 fractions, resp. From this and other detns. it is concluded that the non-glucose fraction is present chiefly in the corpuscles.

S. MORGULIS

Comparative studies on the sugar content of capillary and venous blood following muscle activity. M. DORLE AND W. LIEHR. *Biochem. Z.* **185**, 365–72 (1927).—The changes in blood sugar level of venous or capillary blood of an organ whose muscles are exercised are described. Generally the capillary blood sugar level rises if there is

no fatigue or falls in case fatigue does result. The venous blood sugar level remains more nearly const. S. MORGULIS

Cholesterol metabolism and the reticulo-endothelial system. F. GOEBEL AND H. GNOINSKI. *Biochem. Z.* 185, 484-9(1927).—See C. A. 21, 2929. S. M.

Studies on the physiology of the surviving mammalian heart. II. Comparative studies of the sugar consumption of the surviving cat heart with the older types of apparatus and with the improved Locke-Rosenheim apparatus. GEORG AMBRUS. *Biochem. Z.* 185, 442-9(1927). S. MORGULIS

Studies on the physiology of the surviving mammalian heart. III. The sugar consumption of hearts of different size as a function of the body surface or body weight. ZOLTÁN O-ZÓDI. *Biochem. Z.* 185, 450-69(1927); cf. C. A. 21, 2487.—The heart of cats weighing 2-3 kg. consumes 7 mg. sugar per hr. and per g. of fresh substance, which is greater than indicated by earlier investigations. It is pointed out that the consumption of sugar is more accurately expressed in terms of the dry substance or of the heart with its normal H₂O content (at beginning of expt.) than as is usually done, upon the basis of the wt. at the close of an expt. when the heart had absorbed much water. The sugar consumption of the heart of any species is greater the smaller the heart. The sugar consumption is not related apparently either to the frequency or force of the contraction of the surviving heart. S. MORGULIS

The distribution of oxygen in separate organs according to experiments on angiotomized dogs. E. S. LONDON AND L. M. RABINKOWA. *Biochem. Z.* 186, 155-7(1927).—The blood from the hepatic vein, kidney vein, as well as spleen and pancreatico-duodenal veins contains less N during digestion than in the fasting condition. Passing amino acids through the liver impoverishes the O₂ content of the blood. The right and left kidney veins contain different amts. of O₂. S. MORGULIS

Studies on the effect of high altitude. TH. BRÄHME AND P. GYÖRGY. *Biochem. Z.* 186, 213-21(1927).—The blood reaction changed to the acid side at 2400 m. in one subject, and in both exptl. subjects at 3400 m. altitude. The adrenaline reaction was very much increased at that height. The total base content of the blood is increased. S. MORGULIS

Note on the technic of the Geppert-Zuntz respiration experiment. J. TAECHTNER. *Biochem. Z.* 186, 264-8(1927). S. MORGULIS

"Perspiratio insensibilis": its nature and cause. FRANCIS G. BENEDICT AND CORNELIA GOLAY BENEDICT. *Biochem. Z.* 186, 278-312(1927); cf. C. A. 20, 3492.—87.5% of the total "perspiratio insensibilis" is due to water lost from the skin and lungs. S. MORGULIS

The occurrence of plasmalogen. II. The distribution of plasmalogen in animals. K. INHAUSER. *Biochem. Z.* 186, 360-75(1927).—Organs particularly rich in lipoids have the highest plasmalogen content. No distinct difference was observed between the different sexes but the serum of females seems to have somewhat more plasmalogen than that of males. Furthermore, the av. plasmal content of serum is characteristic for each species. S. MORGULIS

Fat metabolism. I. A. LÖW AND R. PFEILER. *Biochem. Z.* 187, 114-6(1927).—The petroleum ether fraction of the blood fat does not vary under the influence of adrenaline injections. A study of the alc. fraction, however, shows that the extd. lipid of the blood is greatly increased. S. MORGULIS

The lactic acid content of the cerebrospinal fluid. ANNELESE WITTGENSTEIN AND ALMA GAEDERTZ. *Biochem. Z.* 187, 137-45(1927).—In man and dog the lactic acid content of plasma at rest was found to be 15-18 mg. %, and in the cerebrospinal fluid 13-16 mg. %. Where the plasma lactic acid is low it corresponds to that of the cerebrospinal fluid. Expts. on dialysis of serum against NaCl-lactic acid solns. corroborate the view that the cerebrospinal fluid may be regarded as a dialysate of the plasma from the point of view of the lactic acid. The aq. humor of the eye, however, is entirely different in this respect, and its lactic acid content is considerably greater than that of the cerebrospinal fluid or even of the plasma. The lactic acid of the cerebrospinal fluid returns to its normal resting level and much slower than that of the plasma. In various forms of meningitis or tumors the rise in lactic acid of the cerebrospinal fluid is parallel to the fall in glucose. Suboccipital injection of alk. lactate is innocuous, but that of lactic acid causes a rise in lactic acid content of the cerebrospinal fluid and coma-tog. death. Also in *Klin. Wochschr.* 6, 1289-90(1927). S. MORGULIS

Conditions of autolytic ammonia formation in tissues. III. Relation of the tissue ammonia to the purine metabolism. P. GYÖRGY AND H. RÖTHLER. *Biochem. Z.* 187, 1-1219(1927); cf. C. A. 21, 423.—Liver, kidney, thymus and muscle tissue, as well as exts. of the same, can split off NH₃ from Na nucleinate or from adenosine. In blood

there was no evidence of deamination of the Na nucleinate. The course of the NH_3 formation showed the same dependence upon the H-ion concn. and of sugar or lactate with and without these addns. of purines. The optimum deamination with phosphate buffering is at p_{H} 5.2-5.5, except with muscle tissue where the optimum H-ion concn. is somewhat further on the alk. side. The alc. analogy between autolytic NH_3 formation and the deamination of purine bodies leads to the conclusion that the physiol. NH_3 formation in tissues is partly assocd. with the purine metabolism. The cellular NH_3 production would thus appear as a special manifestation of the activity of nucleus. It is further pointed out that the NH_3 metabolism stands in relation to glycolysis and respiration.

S. MORGULIS

The effect of the thyroid gland hormone on cellular metabolism. Experiments on leucocytes. W. FLEISCHMANN. *Biochem. Z.* **187**, 324-7(1927).—Cell respiration and glycolysis of exudate leucocytes from thyroidectomized animals are normal. The respiration of the leucocytes is unaffected by the addn. of thyroxin *in vitro* though the anaerobic glycolysis is markedly increased.

S. MORGULIS

Variations in the blood sugar of cattle. M. S. AWDEJEW, E. L. PROWATOROWA, N. G. SAWITSCH AND E. L. THAL. *Biochem. Z.* **187**, 369-76(1927).—The blood sugar of fasting cows is very low, and carbohydrate food causes no rise in the blood sugar level. The variations in blood sugar of the same animal on different days are greater than those of different animals. No relation was observed between the low sugar level or its variations and the secretion of milk.

S. MORGULIS

Studies on blood sugar following vagus stimulation and its relation to the insulin in muscle tissue. JÜRGEN LEHMANN. *Skand. Arch. Physiol.* **52**, 169-86(1927).—The vagus nerve of rabbits was exposed on both sides in the neck frozen with CO_2 snow and cut. The animals were under urethan anesthesia. The peripheral end of the right vagus was then stimulated (which stimulates the isles of Langerhans) and the changes in blood sugar were observed. The operative procedure, and especially the sepn. of the nerves, produced hyperglucemia. The stimulation of the right vagus gave a definite lowering of the blood sugar in 2 instances, the result was doubtful in 2 other instances and was definitely absent in 3 rabbits. The changes in blood sugar cannot therefore serve as an indicator of the reaction of the islands of Langerhans since Ahlgren has shown that there is an increase in the insulin content of muscles under these conditions of stimulation.

S. MORGULIS

Composition of living organisms. I. Inorganic elements contained in cats. V. S. SADIKOV AND M. K. SHCHEGL'SKA. *Bull. acad. sci. union rep. soviet social* **1926**, 1619-46.—The purpose of this investigation was to find quant. relations of chem. elements which are characteristic of a given species of animals. Seven expts were made on cats aged between 2 and 35 days and 2 expts. on grown cats. Each animal, after being weighed, was heated in an autoclave for 6 hrs. at $180-200^\circ$ whereupon they were transformed into mixtures consisting of an aqueous soln., oily substance and incompletely decomposed bones. On being treated first with ether, then with alc., these mixts. can be resolved into (1) an aq. fraction, (2) an ethereal fraction, (3) an alc. fraction, (4) a residual fraction. Five tables are given containing the percentages of various elements in the 4 fractions obtained from cats of various ages. In the course of the growth of cats the percentage of water in the living organism decreases with the increase of its total wt. Thus the water content is equal to 82.08% for 2-day-old cats, 70.17% for 35-day-old cats. One 6-month-old cat contained 66.6% water; a 2-year-old cat contained 73% water. **Aqueous fraction:** The % of elements C, H and N in the aq. fraction is identical for cats of all ages. The ash content of this fraction consists of water-sol. inorg. substances. Chlorides, phosphates and sulfates in the ashes decrease with the age of the cat, but the P content is about const. The **etheral fraction** is ash-free. The C content of this fraction is generally about 73%, but it decreases by about 5% in the case of very old cats. The **alcoholic fraction** contains chiefly the substances of the nervous system which are insol. in ether; consequently the increase of this fraction during the first weeks of growth of cats is due to upbuilding of the nervous system during this period. This fraction is ash-free. The C content increases with the growth of the cat; the N content is largest in old cats and smallest in well-nourished cats. The **residual fraction** consists chiefly of inorg. substances. The proportion of this fraction changes but little during the growth of cats and represents about 9.5% of their total weight. It contains neither C nor N and is rather rich in P, which chiefly presents itself in combination with Ca. **II. Inorganic elements contained in frogs.** V. S. SADIKOV AND R. A. GUTNER. *Ibid* **1927**, 95-116.—The compn. of frogs was investigated for a comparison with that of cats. While in order to decompose to a structureless mass the organism of a cat, it must be submitted to prolonged heating at $180-200^\circ$, with frog-

it is sufficient to operate at room temp. or at 38° under the action of some autolytic enzymes. Analyses are given for winter frogs which were in a state of hunger, autumn frogs which were well nourished and very young frogs.

BERNARD NELSON

Study of the physico-chemical basis of thrombosis. H. SCHULTE. *Med. Klinik.* 1926, 1003; *Colloides biol. clin. therap.* 1, 73(1927).—In isotonic solns. free from colloids, agglutination of the blood takes place at p_H of 4.3–3.5 and cataphoretic detns. show the isoelec. pt. to be at p_H 3.9–3.49, Na, Ca and Cl ions having no perceptible influence. Since such p_H values are never found *in vivo*, other factors must come into play in agglutination in the formation of thrombus, particularly the presence of other colloids.

A. PAPINEAU-COUTURE

Relations between the nucleic phosphorus index and other phosphorus indexes of the tissues. M. JAVILLIER AND H. ALLAIRE. *Bull. soc. chim. biol.* 9, 772–7(1927); cf. *C. A.* 21, 750, 951.—Tables are given which show the total P, lipidic P, nucleic P and mineral and undetd. org. P in 13 fresh and dry tissues of a healthy horse. The ratios of these fractions of P partition to the total P and to each other are calcd. The figures thus obtained are regarded as evidence that the different tissues contain a normal content of nucleic P, that there exists a physiol. index of nucleic P for each tissue of a given animal species, and that the different tissues vary in this respect so that the content of nucleic P constitutes a true characteristic or true index of each tissue (cf. following abstr.)

L. W. RIGGS

Nucleic phosphorus balance and phosphorus ratios during growth. M. JAVILLIER, H. ALLAIRE AND (Mlle.) SIMONE ROUSSEAU. *Bull. soc. chim. biol.* 9, 778–84(1927). See *C. A.* 21, 3208

L. W. RIGGS

Presence of lithium and strontium in human teeth and bones and their chemical state of combination. A. DESGREZ AND J. MEUNIER. *Compt. rend.* 185, 160–3(1927).—Li exists in bone and teeth as a phosphate. Sr is present as carbonate. It is probable that these elements pass from the blood into these tissues without changing their chem. form

L. W. RIGGS

Modification of the respiratory exchanges after removal of the thyroid or suprarenals from the rat. C. D. MASSEY. *Compt. rend. soc. biol.* 97, 405–6(1927).—After the extirpation of either the thyroid or suprarenals the basal metabolism falls. It falls still more when the other gland is removed, thus showing that each gland has its independent action.

L. W. RIGGS

Determination of respiratory exchanges in the rat and the rabbit. ARGENTINA ARTUNDO. *Compt. rend. soc. biol.* 97, 407–8(1927).—An illustration of the app. and description of the process are given. **Basal metabolism of rats deprived of suprarenals.** *Ibid.* 408–9.—The basal metabolism varied at different temps. In 6 rats which were kept at 30° the basal metabolism was not modified by removal of the suprarenals. **Summit metabolism of rats deprived of suprarenals.** *Ibid.* 409–10.—When the surrounding temp. is lowered during several days from 25° to 18° the metabolism rises more rapidly and distinctly in the decapsulated rats. On placing the rats successively at 30° , 15° and especially at 0° , the metabolism was elevated less after extirpation of the suprarenals. **Glucemia, glycogen and action of insulin in decapsulated rats.** *Ibid.* 411–3.—Rats decapsulated within 2 weeks were very sensitive to the hypoglycemic, toxic and convulsive effects of insulin even with doses which produced no symptoms in the controls. Rats decapsulated within 5 weeks were much less sensitive than the first lot, but much more sensitive than the controls. Hypoglycemia was more prolonged in the first lot than in the second lot or in the controls. Liver glycogen diminishes somewhat regularly according to the individual. Muscle glycogen diminishes more irregularly.

L. W. RIGGS

Glutathione and the reducing properties of tissues of decapsulated rats. B. A. HOUSSEY AND P. MAZZOCCO. *Compt. rend. soc. biol.* 97, 417–9(1927).—The suprarenals were extirpated under ether in 30 sec., a similar operation being made on the controls but without removing the suprarenals. The decapsulated rats showed an increase of reduced glutathione in the muscles which disappears in 32 to 36 days after the operation. The liver contains a variable content of reduced glutathione generally slightly less, while that of the kidneys was higher than in the controls.

L. W. RIGGS

Gastric digestion in children of three to fourteen years. F. LESNÁ, P. ZIZINE AND M. PICQUARD. *Compt. rend. soc. biol.* 97, 445–7(1927).—The gastric contents of about 30 normal children were sampled with the Einhorn tube after test meals of white of egg aromatized by orange-flower water. These samples, analyzed by standard methods, gave free HCl 0.22 g. per l., acids of fermentation 0.32, combined Cl 0.66 and total acidity 1.19. The corresponding figures for adults are 0.50, 0.20, 1.10 and 1.80. Lactic acid was generally present. The p_H value averaged 3.3 instead of 2.4 for adults.

The peptic activity was in proportion to the free HCl present, and was increased by the addn. to the test meal of NaCl, MgCl₂ and CaCl₂. L. W. RIGGS

Distribution of folliculin in the organism. L. BROUHA and H. SIMONNET. *Compt. rend. soc. biol.* **97**, 459-60(1927). Expts. with several species of animals proved that the follicular hormone exists in the blood and milk, but in a concn. inferior to that of the follicular liquid. The uterine muscle contains no folliculin during the diestrus. L. W. RIGGS

Partition of the total nitrogen in the lobes of the frog liver. CL. GAUTIER and H. P. THIERS. *Compt. rend. soc. biol.* **97**, 485-6(1927). The total N content per kg. of the right, left and median lobe of frog liver in May and June was substantially the same. L. W. RIGGS

Relation of smooth muscle tone to oxidation-reduction processes. J. M. JOHNSON, W. T. McCLOSKEY and CARL VORGLIN. *J. Pharmacol. Proc.* **31**, 201-2(1927). The contraction of smooth muscle was observed after substances "which presumably affect biological oxidation-reduction processes" were added to the surrounding bath. Increased tone of guinea pig uterus was seen after cysteine, both forms of glutathione, other amino acids, NaCN, Na₂S, etc. Slight increase in the tone of rabbit jejunum was seen after H₂O₂, reduced glutathione and cysteine. "The conclusion is reached that oxidation-reduction processes influence the tone of the 2 types of smooth muscle used." GEORGE ERIC SIMPSON

Connection between tension and lactic acid formation in muscle during tetanic contraction. JULIUS SURANYI. *Arch. ges. Physiol.* (Pflüger's) **214**, 228-30(1926). The tetanic coeff. in indirect stimulation is definitely greater (some 20%) than with direct stimulation, and the formation of lactic acid is somewhat greater with indirect than with direct stimulation. G. H. S.

Regulation of metabolism. VII. Glycogen deposition in artificially stimulated denervated muscle. AUGUSTE HOFFMANN and ERNST WERTHEIMER. *Arch. ges. Physiol.* (Pflüger's) **216**, 337-40(1927), cf. *C. A.* **21**, 2298. Muscle deprived of nerves gain but little or no glycogen, but if subjected to elec. stimulation large amts. are deposited. G. H. S.

Effect of high altitudes on the animal organism. EMIL ABDERHALDEN, NINA KOTSCHNEFF, E. S. LONDON, A. LOEWY, LUBOW RABINKOWA, GEORG ROSKE, ERNST ROSSNER and ERNST WERTHEIMER. *Arch. ges. Physiol.* (Pflüger's) **216**, 362-95(1927). -- In passing from a low to a high altitude the no. of red cells in the blood increases; it falls if the animal goes from a high to a lower level. In animals native to high altitudes transfer to a lower level caused a reduction in red cells, but it takes place more slowly than in animals indigenous to the plains. Those animals native to high altitudes have an extremely small no. of white cells. In general the no. of white cells are reduced in passing to a high altitude, while the viscosity of the blood varies in different vascular beds, being lower in the peripheral circulation than in deeper beds. The sedimentation velocity of the red cells also varied. The total blood vol. was not changed by passage from one level to another, nor is there any alteration in the p_{H_2O} or blood sugar. The alkali reserve falls upon ascending the mountains, while the K and Ca content show fluctuations and the P_2O_5 is increased. At all altitudes the blood sugar is higher in the hepatic vein than elsewhere, while the peripheral blood and that of the renal vessels are the same. In general there was more fat in the blood of the portal vein than in that of other beds. Blood from the renal vessels showed high Cl values and higher P_2O_5 than the blood from the other regions tested. The degree of O satn. in the blood varies with the vascular bed and is modified by altitude, while the CO₂ tension varies within normal limits. G. H. S.

Effect of some inorganic salts on the contraction capacity of muscles. RUDOLF HÖBER. *Arch. ges. Physiol.* (Pflüger's) **216**, 402-19(1927). -- In general the smooth muscle of both vertebrates and invertebrates is relatively resistant to K while striated muscle is susceptible. G. H. S.

Urine formation in the frog kidney. XI. Secretory activity of the glomeruli. RUDOLF HÖBER and ERICH MACKUTH. *Arch. ges. Physiol.* (Pflüger's) **216**, 420-31(1927). -- Narcotics, KCN and N cause a reversible inhibition of urine formation in the isolated kidney undergoing perfusion with a modified Ringer soln., even though the perfusion rate is not altered. This also happens if the tubules have been treated through the portal vein with sublimate. Treatment of the glomeruli with sublimate also interferes with urine secretion. G. H. S.

Effect of definite hormones on metabolism. III. Effect of adrenaline on conjunction with an adequate diet. P. JUNKERSDORF and H. SCHÜLLER. *Arch. ges. Physiol.* (Pflüger's) **216**, 549-54(1927), cf. *C. A.* **20**, 1442. -- With dogs of various races, different

ages, and in various nutritional states the metabolism varied in accord with the amt. of adrenaline given, its mode of administration, and the physical condition of the animal at the beginning of the expt. **A** G. H. S.

Effect of spermine on the motility of spermatozoa. ERNST REDENZ. *Arch. ges. Physiol.* (Pflüger's) **216**, 605-10(1927).—Spermine does not protract the period of motility of sperm cells. G. H. S.

Physical chemistry of leucocytic emigration. J. JOCHIMS. *Arch. ges. Physiol.* (Pflüger's) **216**, 611-23(1927).—In a neutral isotonic soln. leucocytes migrate in all directions, but if a weakly acid soln. is added (p_H 6.3 or 6.0) they migrate toward the acid. Alk. solns. (p_H 8.5) are without effect on the direction of movement. Migration is not modified by isotonic neutral solns. of NaCl, KCl and $MgCl_2$, but $CaCl_2$ and $BaCl_2$ stimulate movement. G. H. S.

Studies on growth. III. Chemical changes in the entire body and in organs during post-uterine development. DORA HAX. *Arch. ges. Physiol.* (Pflüger's) **216**, 627-39(1927).—Data are tabulated showing the variations in glycogen, fat and water content of different organs of dogs at various ages after birth. **IV. Changes in the weight and in the chemical composition of the entire body and of organs during fetal development. Changes in the body of the mother during pregnancy.** FR. LIESENFELD, H. DAHMEN AND P. JUNKERSDORF. *Ibid* 712-28. —In the mother the most outspoken changes are those of the liver and heart, in the fetus the characteristic changes are those involving the relative wt. and chem. compn. of the liver, thymus, kidneys, spleen, pancreas and heart. G. H. S.

Secretion of the adrenals in angiotomized dogs. P. J. POWOW. *Arch. ges. Physiol.* (Pflüger's) **216**, 651-6(1927).—The blood of such animals contains an increased content of adrenaline. G. H. S.

The all-or-none law and metabolism. HANS WINTERSTEIN AND ELSE HIRSCHBERG. *Arch. ges. Physiol.* (Pflüger's) **216**, 671-80(1927).—The O utilization of the spinal cord, peripheral nerves, skeletal muscle and gastric musculature of frogs in salt soln. under elec. stimulation increases with the increase in stimulation. Frog stomach in an O atm. shows a reversal of this relationship. With frog heart the O use is quite independent of the degree of stimulation. G. H. S.

Physiology of the thymus glands. F. D. AGAFONOW. *Arch. ges. Physiol.* (Pflüger's) **216**, 682-96(1927).—In frogs bilateral extirpation of the thymus does not lead to any serious ill effects. Exts. of the gland are active on the frog heart when applied by any method, and when injected intravenously into mammals they affect the inhibition app. of the heart. The administration of atropine prevents the characteristic reaction of the exts. Exts. prepd. *in vitro* do not accelerate blood coagulation. The effect on the blood pressure is not removed by elimination of the choline. The exts., given intravenously, cause first a reduced irritability of the nerves, and later an increase. Treatment of the exts. with alc. or acetone deprives the exts. of some of their effects on heart and nerves. In many respects exts. of lymph nodes react as do preps. of the thymus, although they are without effect on the pulse and the irritability of the vagus. G. H. S.

Sex specificity of the internal secretions of the germinal glands. JOACHIM LEHMANN. *Arch. ges. Physiol.* (Pflüger's) **216**, 729-48(1927).—Specificity of the hormones is demonstrated. G. H. S.

A hormone of heart activity. VI. Stimulus substance of the heart. L. HABERLANDT. *Arch. ges. Physiol.* (Pflüger's) **216**, 778-88(1927); cf. *C. A.* **21**, 1143. **VII. Independence of the formation of stimulus substance from the sympathetic nervous system of the heart.** *Ibid* 789-95.—A stimulating substance is demonstrated, whose origin is independent of the sympathetic system. G. H. S.

Reaction of the blood in frogs. LIDIA HERTWIG-HONDRU. *Arch. ges. Physiol.* (Pflüger's) **216**, 796-7(1927).—By giving boric acid by mouth the reaction of the blood could be changed from p_H 7.46 to 7.39, while Na_2CO_3 given in the same way caused a shift from 7.46 to 7.92. G. H. S.

LABBÉ, MARCEL, AND VIOLLE, P. L.: *Le métabolisme de l'eau*. Paris: 1927. Masson & Cie. 256 pp.; 28 francs. Reviewed in *Bull. soc. hyg. aliment.* **15**, 262-3(1927).

G—PATHOLOGY

H. GIDEON WELLS

Blood sugar and urinary D:N ratio in the hours following pancreatectomy. W. CHAMBERS. *Am. J. Physiol.* **76**, 205-6(1926); cf. *C. A.* **21**, 764.—During the opera-

tion there is a distinct fall in N excretion and no change in blood sugar. There is a rapid rise in both following pancreatectomy with a max. at about the 21st hr.

J. B. BROWN

Blood changes and experimental cretinism, hyperthyroidism and myxedema. MARGARETE M. KUNDE. *Am. J. Physiol.* **76**, 225(1926).—In rabbits suffering from hypothyroidism the following blood changes are noticed: marked secondary anemia, with low hemoglobin and red cell count; increased cholesterol; and not much change in Ca. After administration of thyroïl there is a polycythemia, with hemoglobin still below normal, decrease in cholesterol and slight increase in Ca. H_2O is excreted from the skin. The cretin scales are high in cholesterol.

J. B. BROWN

Edema by perfusions with saline solutions and the reaction of the perfusion liquid. TULLIO GAYDA. *Arch. sci. biol.* **9**, 354 61(1927).—When a prepn consisting of the head, heart and extremities of a frog is perfused with Ringer-Locke soln., an edema is produced in these organs which varies with the p_H of the soln. The edema is a min. for p_H 4.7, while for values either above or below this the value first increases and then decreases, having 2 maxima at p_H 3.1 and 10.3. Since p_H 4.7 is the isoelec. point for muscular protein material, and since the variation in intensity of edema with p_H corresponds to the variation in osmotic pressure with p_H , G. concludes that edema by perfusion with saline solns. is a phenomenon of osmosis.

A. W. CONTIERI

Different behaviors of the central and cortical substances of the crystalline lens in post-mortem cataract. G. BUGLIA. *Arch. fisiol.* **24**, 451-9(1926); *Physiol. Abstracts* **12**, 15. —The isoelec. point of the protein of the cortical substance of the crystalline lens is more displaced toward the acid zone than that of the protein of the central or nuclear portion. In addn, the cortical protein has a greater capacity to mask the H^+ than the nuclear protein. This explains why the 2 portions of the lens behave somewhat differently in the so-called post mortem cataract as well as in certain other forms of opacity of the same tissue.

H. G.

A new protein from the placenta in a case of nephrosis of pregnancy. ERNST SCHWARZKOPF AND HERMANN SIEVERS. *Deut. med. Wochschr.* **53**, 1303-4(1927).—A protein of the Bence-Jones type was derived from the placenta in the case of a nephrosis of pregnancy. Initial pptn. of the new protein took place at 65°, max. pptn. at 85°, and partial soln. above 85°.

ARTHUR GROLLMAN

The blood peptide nitrogen in arterial hypertension. HENRY JACKSON, JR., D. W. SHERWOOD AND OLIVE J. MOORE. *J. Biol. Chem.* **74**, 231-3(1927).—In a series of 50 cases, 34 of whom had hypertension, no evidence was found to show that the peptide N in hypertension rises sufficiently to be of etiological importance.

A. G.

Oxygen consumption, oxygen debt and lactic acid in circulatory failure. JONATHAN MEAKINS AND C. N. H. LONG. *J. Clin. Investigation* **4**, 273-93(1927).

A. G.

The cholesterol problem in gastric pathology. LEO JARNO. *Wiener med. Wochschr.* **77**, 1005 6(1927).—Gastric ulcer is accompanied by a hypocholesterolemia which may be influenced by *salvarsin* medication. There is a definite inverse relation between the blood cholesterol values and gastric acidity.

ARTHUR GROLLMAN

Tuberculous meningitis, tuberculoma and the total chlorides in the spinal fluid. R. L. PITFIELD. *Arch. Pediatrics* **44**, 502-7(1927).—The total chlorides of the spinal fluid were decreased in a fatal case of tuberculous meningitis (581 mg. per 100 cc.) and in a fatal case of tuberculoma of the medulla (650 to 707 mg.).

JOSEPH S. HEPBURN

The enzyme theory of antibody formation. W. H. MANWARING. *Sci. Monthly* **1927**, 362 9.

E. H.

The calcium content of the tissue fluids in spasmophilic and non-spasmophilic conditions. N. MALMBERG. *Acta paediatr.* **6**, 241 9(1926); *Ber. ges. Physiol. expil. Pharmacol.* **40**, 232.—The Ca content of tissue fluids in tetanic and normal infants was the same as that of the blood.

MARY JACOBSEN

The pathology of metabolism in obesity. H. C. HAGEDORN, C. HOLTEN AND A. HECHT JENSEN. *Arch. Internal Med.* **40**, 30 7(1927).—After 2 days of a diet consisting chiefly of carbohydrates the respiratory quotient was lower in obese than in normal persons, the lower, the higher the percentage of overweight. Conclusion: Obesity is caused by excess conversion of carbohydrate into fat.

MARY JACOBSEN

Calcium studies in jaundice. With special reference to the effect of parathyroid extract on the distribution of calcium. A. CANTAROW, S. M. DODEK AND BURGESS GORDON. *Arch. Internal Med.* **40**, 129-39(1927).—In jaundice the serum contained 9.3-12 (normally 10.09-10.45), the blood 4.8-12 mg. Ca per 100 cc. The Ca content reached the normal level 12 hrs. after the administration of parathyroid hormone. The Ca deficiency is probably caused by the excess bile acids in the blood. The tendency of jaundiced tissues to bleed is favorably influenced by the treatment.

M. J.

Diseases of the liver. VI. A comparative study of certain tests for hepatic function in cases of cirrhosis of the liver. C. H. GREENE, C. S. McVICAR, A. M. SNELL AND L. G. ROWNTREE. *Arch. Internat. Med.* 40, 159-81(1927); cf. *C. A.* 20, 3503.—Of the tests studied, fructose tolerance, N partition, fibrinolytic element, serum bilirubin (I) and phenoltetrachlorophthalein (II) only I and II are of clinical importance in liver cirrhosis. I is particularly valuable in detg. the degree of bile retention. II is always present and more pronounced than might be expected from I. It is particularly useful in liver cirrhosis with ascites and serves as "an index to the existing functional balance between degenerative and reparative changes in the liver. As such the observations are largely independent of the amt. of ascitic fluid" MARY JACOBSEN

Blood bilirubin. Estimation and clinical significance. F. S. PERKIN. *Arch. Internal Med.* 40, 195-202(1927).—The normal bilirubin content as detd. by the Thannhauser-Andersen method in P's modification was 0.5-3.5 mg. per 100 cc. blood independently of age and sex. It is but slightly affected by pigmentation and only slightly lowered by fasting. It suffers significant changes in As and Pb poisoning, various liver and gall bladder diseases, pernicious anemia and purpura. Although a valuable diagnostic aid in liver diseases it often does not permit differential diagnosis. The test is particularly recommended for the early detection of possible liver damage in patients receiving As.

MARY JACOBSEN

Effect of exercise on respiratory exchange in heart disease. II. J. M. H. CAMPBELL AND F. J. SALE. *Arch. Internal Med.* 40, 237-50(1927).—Exercise equiv. to slow and ordinary walking produced little change from normal (3 patients). There was a linear increase of ventilation and circulation with the work done. The O_2 intake was only slightly higher than normal. The CO_2 elimination showed greater differences, causing the respiratory quotient to fall more than usually in the beginning and to rise considerably more toward the end. The CO_2 % in the expired air was low since overventilation had to compensate for defective circulation.

MARY JACOBSEN

Study of the physico-chemical properties of tissues in relation to the normal and pathological condition of the organism. II. Study of mouse tissues and tumors. F. VLÈS AND A. DE COULON. *Arch. phys. biol.* 5, 125-60(1926); cf. *C. A.* 20, 1249.—A new series of expts. with C, emery powder, corundum, Au, Fe, Zn, Pb and staphylococci injections and with burns confirmed the former findings: the receptivity of mice for implanted tumors increases and decreases parallel with the p_H of the isoelec. point. From the therapeutic point of view the following substances are of interest which produce a progressive and relatively lasting, even if not very powerful, inhibitory effect: coarse emery powder, C, Au and possibly also burns. There is no distinct relation between the chem. nature of the substance employed and its effect. It is noteworthy that at the time zero the receptivity was always the same in spite of the variety of the substances employed. The min. p_H is usually coincident with the interval between the critical point (inversion of the receptivity index) and the min. receptivity. A powerful inhibitory effect is mostly associated with a long interval between injection and critical point and between the latter and min. receptivity. III. Studies of human serum. *Publ.* 161-211.—Within the p_H limits studied (5-12) human normal and pathol. sera exhibit certain, more or less const., isoelec. points. For normal adult men these points are: α at about 5.5, β below 5.0, γ between 9 and 12, δ above 12. Not all points are always represented by the same sample. In the serum of women γ is mostly absent, except in pregnancy when it is usually very low, and, like α , subject to considerable fluctuations. The α of virgins is remarkably const., 5.5; that of mature women is 6.5. There is a pronounced displacement, mostly an increase of α in acute infectious diseases and in syphilis, a less pronounced one in more chronic processes, like tuberculosis. In these conditions γ is rarely present. Severe cases with impending death are often associated with a complete absence of isoelec. points between p_H 4 and 12. The isoelec. points may be influenced by medication. Their displacement in dependence upon the condition of health permits an interpretation of the various serum flocculation reactions.

MARY JACOBSEN

The blood calcium of patients with bone fractures during the period of callus formation. LUIGI BAJ. *Gior. batteriol. immunol.* 2, 94-100(1927); *Ber. ges. Physiol. u. exp. Pharmacol.* 40, 550-1.—The blood Ca is above normal during the period of callus formation. Immediately after the fracture it is 10.2 mg/100 cc. in patients 5-14 years old and 8.4 mg. in adults (controls 9.3 and 7.85, resp.). A max. is passed on the 18-22nd day, 10.8 and 8.9, resp. The values decrease subsequently but remain above normal for some time after clinical recovery. Only 1 case presented progressive Ca decrease of unknown origin.

MARY JACOBSEN

The mechanism of the action of curative vaccines. The behavior of a few physico-

chemical properties of the serum of children treated with typhoid vaccine. MICHELE GERBASI. *Pediatrics rivista* 35, 857-76(1927).—The changes of surface tension and serum protein during vaccine shock vary in degree and sign. The conductivity is first increased, then notably diminished at the height of shock. These phenomena were observed in normal children and in typhoid patients.

MARY JACOBSEN

Changes in the physico-chemical constants of blood in anemia. II. Viscosity and coagulability. M. GIUFFRÉ. *Pediatrics rivista* 35, 877-80(1927); cf. *C. A.* 21, 2734.—Various forms of anemia (aplastic, Jaksch-Hayem, leishmaniasis, infantile scurvy, luetic hemolytic icterus) are associated with a constant decrease of viscosity and an increase of coagulation time.

MARY JACOBSEN

Blood phosphorus in some diseases of childhood. ALESSANDRO LAURINISCH. *Pediatrics rivista* 35, 913-9(1927).—The blood P was 4.84 mg/100 cc. in 25 normal, and 3.19 in 25 adenoid children; 2.2-3.0 in mongolism, 3.1-3.3 in myxedema, 5.1-3.1 in Oppenheim's disease (a few cases each). Deaf but normal children had a normal blood P.

MARY JACOBSEN

Erythrocyte resistance in anemias of infancy. S. BARBERI. *Pediatrics rivista* 35, 935-45(1927).—The max. and mostly also the medium resistance to hypotonic NaCl is increased in regenerative and decreased in non-regenerative anemias. The min. resistance is mostly normal, sometimes lowered. With the progress of clinical improvement the resistance tends to become normal, but a return to normal means an unfavorable prognosis when it is associated with an otherwise aggravated condition. When the hemolysis is preceded by CO₂ treatment the behavior resembles that of whole blood.

MARY JACOBSEN

Indicanemia in nephritics and the experimental production of nephritis by indole. G. PHOCAS. *Ann. inst. Pasteur* 41, 576-81(1927).—The elimination of indican is increased in the urine of nephritics. The indicanemia in this case is probably the result of an overproduction of indole. Nephritis once established probably tends to retention of indican. Small doses of indole, individually harmless, when given over a long period of time lead to chronic nephritis in the rabbit. On the theory that indole produced in ordinary human metabolism tends to cause nephritis P. advocates the therapeutic use of small daily doses of sulfuric ions and glucose to detoxicate the indole, where there is evidence of its excessive production.

E. R. LONG

Effect of mechanical obstruction of the hepatic veins upon the outflow of lymph from the thoracic duct. J. P. SIMONDS AND W. W. BRANDES. *J. Immunol.* 13, 11-7 (1927). Simple mech. obstruction of the hepatic veins in otherwise normal dogs increases the outflow of lymph from the thoracic duct from 2.4 to 6.2 times, with an av. of 5.2 times the normal. Since, as previously shown, little or no blood escapes from the liver during the height of anaphylactic and peptone shock, it is suggested that engorgement of the liver due to obstruction to outflow of blood may be an important factor in the increased output of lymph in these 2 types of shock. The substance produced when homologous serum passes through the liver of a sensitized animal is not entirely identical with peptone in its action, lacking the powerful lymphagogic effect of peptone.

E. R. LONG

Relation of anaphylaxis to immunity. I. Passive desensitization in dogs. W. H. MANWARING, P. W. SHUMAKER, R. W. WRIGHT, D. L. REEVES AND H. B. MOY. *J. Immunol.* 13, 59-62(1927), cf. *C. A.* 20, 2879.—Immune blood contains a desensitizing substance capable of causing complete desensitization of hypersensitive fixed tissues, but no antibody that serves as a demonstrable circulating defense to hypersensitive fixed tissue. All phenomena of passive desensitization or passive immunization thus far studied in dogs may be accounted for as a result of the action of this desensitizing antibody. The sensitizing and desensitizing antibodies appear to be of different chem. constitution; neither is identical with the sp. precipitin of test tube reactions. **II. The phenomenon of antianaphylactic immunity.** W. H. MANWARING, D. L. REEVES, H. B. MOY, P. W. SHUMAKER AND R. W. WRIGHT. *Ibid* 63-7.—Tissues of actively immunized dogs transplanted by vessel anastomosis into hypersensitive recipients show a complete acquired insusceptibility to the hepatic anaphylatoxin. The hepatic anaphyl-toxin, therefore, must be regarded as a secondary antigen, presumably of protein nature, and conceivably a denaturation product of the primary antigen.

E. R. LONG

Studies in hypersensitiveness. XXIV. The question of identity of the atopens of the pollens of high ragweed and low ragweed. AARON BROWN. *J. Immunol.* 13, 73-8(1927).—Equal sensitiveness of hay-fever patients to high and low ragweed pollens, and similar prophylactic value of preps. from the 2 sources, indicates the identity of the atopen of the 2 pollens.

E. R. LONG

Alcohol-soluble specific substances of *B. diphtheriae* and of *Streptothrix*. J. FRUND. *J. Immunol.* 13, 161-9(1927).—The antigens of the bacterial suspension and the alc. ext. of the diphtheria strain used could not be differentiated by absorption. Diphtheria toxin is a different antigen from both the alc.-sol. antigen and the antigens demonstrable in non-toxic diphtheria bacillus emulsion. The alc.-sol. sp. substance of *B. diphtheriae* is sol. in MeOH, acetone and weak alkali, and insol. in Et_2O , weak acids and water. The N content of 2 purified preps. was 5.6 and 5.7%. After hydrolysis the biuret reaction was negative and the ninhydrin positive. Pepsin and trypsin did not increase the potency of a purified prepn. for the complement-fixation test. The addn. of an alc. soln. of lecithin to the alc. ext. of *B. diphtheriae* increased its potency in the complement-fixation test 4 times. The soly. of the sp. substance makes its protein nature improbable. An alc.-sol. sp. substance was demonstrated in a *Streptothrix* strain. The addn. of an alc. soln. of lecithin to the alc. ext. of *Streptothrix* increased its potency in the complement-fixation test 200 times in a mixt. contg. 2% alc. ext. No alc.-sol. substance could be demonstrated in *B. xerosis*, *Trichophyton*, *Actinomyces* and yeast.

E. R. LONG

Action of enzymes on the protective antibody of pneumococcus. L. D. FELTON AND GLADYS KAUFFMAN. *J. Immunol.* 13, 219-35(1927); cf. *C. A.* 20, 1455.—Protective antibodies, as found in the water-insol. protein fraction sepd. from Types I, II and III antipneumococcus horse serum by diln. in water, were digested by pepsin, trypsin, pancreatin and papain with a loss of their protective property. The loss appeared to parallel the extent of protein cleavage. Prolonged contact of the antibody soln. with rennin, ptyalin, amyllopsin, taka-diasase and malt diastase resulted in loss to varying degree, ptyalin and rennin being the least destructive. Huntton's antibody was completely destroyed by pepsin, trypsin and pancreatin.

E. R. LONG

Experimental immunization with bacteria detoxicated by gold chloride. M. B. OSMAN. *J. Immunol.* 13, 243-64(1927).— AuCl_3 has a marked detoxicating action on various bacteria. The power of bacteria detoxicated by AuCl_3 to stimulate agglutinin production is slight. Animals immunized with such detoxicated organisms, however, tolerate large doses of live organisms.

E. R. LONG

The bacteriophage-antibacteriophage reaction. EMIL WEISS. *J. Immunol.* 13, 501-9(1927).—Bacteriophage mixed with antibacteriophage serum and incubated 24 hrs. at 37° or longer shows the following properties: Filtered through a colloidal sac, it does not influence bacterial growth. It does not penetrate an av. agar layer in a Petri dish, although bacteriophage penetrates it where mixed with normal serum or alone. It is pptd. by 13.5% Na_2SO_4 , but remains in the filtrate when mixed with normal serum or alone. Bacteriophage is not destroyed by its union with antibacteriophage serum. When a mixt. of bacteriophage and antibacteriophage serum is digested with trypsin, the bacteriophage again appears active.

E. R. LONG

Bacteriophage purified with lipoids. EMIL WEISS. *J. Immunol.* 13, 311-7(1927).—Bacterial proteins in a phagic fluid can be pptd. by lipoids in proper concn. This purified bacteriophage produces only antilynsins, is non-toxic, has no prophylactic value and is very useful for therapeutic purposes on rabbits infected with Shiga bacilli.

E. R. LONG

Relation of anaphylaxis to immunity. IV. Normal and anaphylactic detoxication of specific foreign proteins. W. H. MANWARING, D. H. MARINO, T. C. MCCLEAVE AND T. H. BOONE. *J. Immunol.* 13, 357-63(1927); cf. *C. A.* 20, 2879.—Titrations by means of rabbit precipitin indicate that horse proteins injected intravenously into normal dogs are retained apparently quantitatively in the circulating blood for at least 4 days. Nevertheless, transfusions of these bloods into partially exsanguinated hypersensitive recipients show that by the end of 4 days the circulating horse proteins are so altered that they are no longer capable of calling forth recognizable anaphylactic reactions in horse serum hypersensitive tissues. In horse serum hypersensitive donors, a gradual complete anaphylactic detoxication of horse proteins, also without demonstrable quant. reduction, takes place in 10-18 hrs. These results favor the view that marked chem. alterations take place in sp. antigens when injected into the animal body, and that many of the essential immunologic adaptations are to the resulting denaturation products (secondary antigens) rather than to the primary antigens originally injected.

E. R. LONG

The relatively heat-stable components of complement. H. R. WHITEHEAD, JOHN GEDDON AND ARTHUR WORMALL. *J. Immunol.* 13, 439-49(1927).—Small quantities of H. or amines inactivate complement by destroying a relatively heat-stable component not identical with the 3rd component. A 4th component of complement is, therefore, postulated. The action of NH_3 is sp., as other alkalis have no similar effect. The

relatively heat-stable components of serum are much more stable toward ultra-violet light than the heat-labile components. E. R. LONG

The action of pancreatic extracts on complement. II. The relationship between proteoclastic and anticomplementary powers of different enzyme extracts. ARTHUR WORMALL, H. R. WILKINSON AND JOHN GORDON. *J. Immunol.* **13**, 451-7 (1927); cf. *C. A.* **19**, 2852. The proteoclastic and anticomplementary powers of 3 pancreatic exts. ran parallel. Hence shows that these 2 functions of a pancreatic ext. reside in 2 different substances and not in the same one. E. R. LONG

Observations with the precipitin reaction. LUDVIG HEKTOEN. *J. Immunol.* **14**, 1-8 (1927). Review. The serum proteins, hemoclobin and the sp. precipitinogen of senescent appear to be closely related in many distinct species. Casein also may fall in the latter group. Hemoclobin the blood reveals a much wider antigenic relationship than is observed in the case of casein. It is important and of great theoretic interest that the sp. antigens can evoke the formation of corresponding antibodies in the same species under certain conditions. E. R. LONG

A colorimetric reaction between gold chloride and toxins apparently indicative of toxic strength. Preliminary report. LUCY MITCHELL AND CHARLES KRUNWIEDE. *J. Immunol.* **14**, 1-8 (1927). Toxin values in most instances closely approximating those obtained by animal test were secured by means of a colorimetric reaction obtained by adding AuCl₃ to toxic filtrates. No colorimetric end point corresponding to the combining value (toxin:toxoid) of toxins was observed. The mechanism of the reaction was not studied. E. R. LONG

The heterogenetic haptenes. IV. K. LANDSTEINER AND P. A. LEVENE. *J. Immunol.* **14**, 81-90 (1927); cf. *C. A.* **19**, 2853 and *Proc. Soc. Exptl. Biol. Med.* **23**, 343 (1926), **24**, 693 (1927). The crude material from alc. exts. of horse kidney was freed from H₂O sol. substances, dissolved in 20 pts. hot pyridine, allowed to stand in the ice box 24 hrs., filtered and evapor. almost to dryness. The residue was dissolved in CHCl₃ and poured into Me₂CO. The ppt. after drying was extd. with a mixt. of equal pts. CHCl₃ and MeOH. The residue, except for a small fraction, dissolved in hot H₂O. One-half vol. Fehling's soln. added to the aq. soln. caused a gelatinous ppt., which after suspension in H₂O acidified with HCl was reprecip. with alc., Et₂O or Me₂CO. A white powder was obtained of the compn. C 55.39, H 9.22 and N 2.15%. The residue left after the hot H₂O extn. was dissolved for the most part in boiling H₂O, and the soln. clarified by centrifuging. Fehling's soln. pptd. a material sol. in a little 10% HCl. On addn. of Me₂CO a ppt. came down which on drying to a white powder had the following compn.: C 40.91, H 6.78 and N 1.79%. Both products were serologically active. The substance with the lower C value gave complement fixation with heterogenetic immune serum in high diln. and on injection into animals produced hemolysis. On acid hydrolysis 100 mg. reduced a quantity of Fehling's soln. corresponding to 28 mg. glucose. The compn. of the preps. suggests that they contain sp. groups similar to the bacterial haptens studied by Avery and Heidelberger. E. R. LONG

The chemical nature of immune substances. MICHAEL HEIDELBERGER. *Physiol. Rev.* **7**, 101-28 (1927). Review and bibliography. A relationship exists between group specificity and chem. compn. in the sol. sp. substances of the 3 antigenic types of *Pneumococcus*. Even with such widely different bacteria as *Pneumococcus* type II and the type B Friedlander bacillus, a certain similarity in the chem. nature of their sp. polysaccharides is accompanied by a corresponding similarity in the immunological properties of the organisms themselves. The structure of the polysaccharide of type III *Pneumococcus*, the only one so far investigated in detail, appears different from that of any known non-nitrogenous sugar deriv. E. R. LONG

Distribution of iodine with especial reference to goiter. J. F. McCLENDON. *Physiol. Rev.* **7**, 189-258 (1927). Review and extensive bibliography. I is of very wide distribution, and is more or less concentrated by the leaves of plants and the thyroid glands of animals. Goiter is due to a deficiency of I. The prevention of goiter is of the utmost importance in pregnancy, during which the use of iodized salt is of great value. Endemic goiter is the easiest known disease to prevent (Kimball). E. R. LONG

Phlorhizin diabetes. T. P. NASH, JR. *Physiol. Rev.* **7**, 385-430 (1927); cf. *C. A.* **20**, 1106. Review with extensive bibliography. E. R. LONG

The distribution of protein in the blood in experimental anemia. MEYER BODANSKY, STANLEY W. MORSE, VEON C. KIECH AND ROBERT B. BRAMKAMP. *J. Biol. Chem.* **74**, 463-71 (1927). "The distribution of the protein fractions in the plasma and serum of the dog has been studied according to Howe's method (*C. A.* **16**, 729). Of the globulin fractions, pseudoglobulin I was usually predominant; of the albumins,

fraction VIII was usually present in greatest amt. A small quantity of protein is pptd. when serum from defibrinated blood is added to 0.5 M NaCl (the concn. of Na_2SO_4 which pptd. fibrinogen). The albumin globulin ratio of the serum proteins diminished during exptl. period as judged by acetylphenylhydrazine. Invariably, the fibrinogen content of the plasma and the globulin fraction of the serum increased in amt., and the 0.75 M fraction of the serum was increased in nearly every case. A tendency to return to normal values was observed in several expts. in which the animals were allowed to recover. More than half of the total protein, including hemoglobin, liberated from normal corpses by hemolysis in dil. salt soln. may be salted out within the pptn. limits of the globulins. It is possible that a part of the extra protein salted out as albumen and globulin may have had its origin in the hemolysis of the corpses.

A. P. LÖNNBERG

Nitrogenous metabolism in postencephalitic rigidity. M. HIRST AND C. G. IMRIE. *Proc. Physiol. Soc., J. Physiol.* **62**, iv-vi (1926). No close and constant relation between encephalitic rigidity and uric acid excretion could be established. Great uricuria was found in all 4 cases of encephalitic rigidity studied. J. F. LYMAN

Urobilin studies. II. The place of formation of urinary urobilin. E. B. SÄLEN AND B. ECKELÖF. *Acta med. scand.* **66**, 366-442 (1927). The occurrence and the variations in the symptoms of urobilinuria and bilirubinuria are very largely independent of the degree of cholemia. Cases are cited to demonstrate extensive urobilinuria without pathol. cholemia and vice versa. Furthermore, the presence of urobilin in urine and intestine is demonstrated in spite of the fact that no bile passed for a long time through the bile ducts, whereby it is also shown that the urobilin has been absorbed from the intestine and that it was derived from bilirubin from the blood. This explains why in instances of severe liver injury a small amt. of urobilin in the intestine suffices to cause considerable urobilinuria. S. MORGULIS

Studies concerning the variations of the blood-sugar reactions in disease. OESTEN HOLTEN. *Acta med. scand.* **66**, 443-60 (1927). Blood sugar tests were made repeatedly on 10 healthy persons, 29 patients with arthritis and 38 patients with various other maladies, 100 g. glucose being given in each case. Most acute diseases showed a higher and more protracted blood sugar reaction during the active stage, while all chronic cases showed a greatly variable reaction even during the active stage. S. MORGULIS

The potassium and calcium content of blood serum under normal and certain pathological conditions. A. BREMS. *Acta med. scand.* **66**, 473-83 (1927). The very high K values found by some observers are attributed to the fact that the serum was not quickly separated from the red cells. The av. normal values found are 17.94 mg. % K and 11.48 mg. % Ca with a K/Ca = 1.62. The Ca value varies little from the normal in essential hypertony, bronchial asthma or diabetes mellitus. The K values, on the other hand, not in each individual case are considerably increased in hypertony and asthma (17.7 and 20.19 mg. %) and to a lesser degree in diabetes (18.51 mg. %). The K/Ca ratio is normal in the latter but in the former 2 diseases is increased to 1.81. No connection was discovered between the K/Ca ratio and the adrenaline reaction.

S. MORGULIS

Clinical investigations into the basal metabolism in diseases of the thyroid gland. ROBERT MÖLLER. *Acta med. Scand.*, Suppl. xxi, p. 219 (1927).—The basal metabolism was made according to Krogh's method, and the Harris-Benedict standards were found to give the best expression of the metabolic rate. In a series of 89 cases of Graves's disease, 70 exhibited the true disease (goiter, tremor and permanent tachycardia) and the remaining 19 were classified as Grave's "formes frustes." The basal metabolism in 721 detns. was found to vary from 99.1 to 190.2%. In 10% of the patients with true Grave's disease it was below 110%. In the formes frustes the basal metabolism varied from 95.8 to 138.1%, being below 110% in 69% of the cases. A study of the various symptoms of Grave's disease leads to the conclusion that a basal metabolic rate within normal limits should not exclude a diagnosis of this disease, the arrangement of the common symptoms in the order of their frequency being: tachycardia, tremor, goiter, nervousness, increased metabolism, palpitation, increased sweat secretion and exophthalmos. Treatment by rest and overfeeding usually occasioned a lowering of the basal metabolism 10-20% within 2-4 weeks. X-ray treatment likewise produces abatement of symptoms, the basal metabolic rate usually decreasing after general abatement of all other symptoms. The x-ray treatment was successful in at least 13 of the cases studied. In 5 patients with toxic adenoma of the thyroid basal metabolism values of 113.7-129.2% were found, and in 20 out of 21 patients with simple goiter normal values were found. A large number of metabolic detns. were also made on 18 myxedema cases, 2 cachexia strumipriva and 3 cases of slight hypothyroidism. In

the former 2 conditions the metabolic rate did not diminish below 60%; in the latter it was about 90%. The effect of thyroid treatment in these patients was to increase the metabolic rate, the rise first appearing after 2-3 days and reaching a max. in 2-8 weeks.

S. MORGULIS

Does diabetic serum contain substances which affect the permeability of the cells to glucose? E. BISSINGER. *Biochem. Z.* 185, 229-37(1927).—The results of Geiger and Loewi are corroborated in that the surviving frog liver does not absorb much glucose when diabetic serum is added to the perfusion sugar solu. The free sugar in the liver tissue under these exptl. conditions is increased, and the resulting diminution in the diffusion potential is held responsible for the lowered glucose absorption rather than a primary alteration in cell permeability.

S. MORGULIS

The role of the pancreas in some toxic glucemias. I. A. BORNSTEIN AND R. D. LOEWENBERG. *Biochem. Z.* 186, 243-51(1927).—The blood sugar is equally affected by pilocarpine, narcosis or ergotamine in normal and pancreatectomized dogs which are given continuous intravenous injections of glucose and insulin. The glucemia of pilocarpine and narcosis are therefore essentially independent of the pancreas.

S. MORGULIS

A note on the relations between blood sugar, cholesterol and hypertony. M. DORLE AND W. LEHR. *Biochem. Z.* 187, 385-7(1927).—No definite relationship has been found between the blood sugar or cholesterol level and blood pressure in cases of arteriosclerosis and hypertony.

S. MORGULIS

The difference between the homologous and heterologous complement-fixation reaction. R. TORIKATA. *Centr. Bakt. Parasitenk. 1. Abt.*, 103, 129-47(1927).—Antigens for the homologous complement fixation reaction consist of 2 parts, a protein and a lipid. Specificity depends on the protein and complement-binding energy on the lipid. The antigen in the heterologous reaction is a lipid only. It reacts with serum proteins in order to bind complement.

JOHN T. MYERS

Rate of sedimentation in digestive hemoclasia. M. POPPER AND F. KREINDLER. *Paris médical* 16, 128(1926); *Colloides biol. clin. thérap.* 1, 38(1927).—Investigation of the rate of sedimentation of red corpuscles may be of great importance in revealing digestive hemoclastic shock. The rate of sedimentation differs in normal and hepatic subjects even merely after ingestion of milk. In subjects exhibiting a normal liver activity, the rate of sedimentation is the same before ingestion of milk and 45 min. after. In hepatic subjects 3 different classes of results may be obtained, permitting of differentiating between 3 types of affection of the organ: (1) in the case of patients shown by clinical symptoms to be suffering most severe affections of the hepatic cell, sedimentation is accelerated, probably through a disturbance of the proteoplectic function of the liver, allowing of the passing into the general circulation of proteins having a low degree of dispersion, which facilitates sedimentation; (2) there is a retardation of sedimentation, owing to the passing into the blood of finely dispersed proteins, which inhibit sedimentation; (3) there is no change in the rate of sedimentation, showing that the proteoplectic function of the liver is intact. These hypotheses have been confirmed by detn. of the proteins in the plasma, an inversion of the plasmatic formula (relative ratios of fibrinogen, albumin and globulins) being observed, corresponding to the change in rate of sedimentation.

A. PAPINEAU-COUTURE

The isoelectric point of rabbit serum in relation to the development of cancers by tar. A. DECOULON, J. NICOD AND F. VLÉS. *Arch. phys. biol.* 4, 245-63(1927).—If the development of tumors, papillomas or true cancers follows the painting of rabbits with tar the serum of such rabbits shows variations in its isoelec. points. In the case of papillomas the α point undergoes oscillations more or less irregular. Each change of the growth (increase, decrease, appearance of malignity, etc.) is preceded or accompanied by perturbations of the isoelec. point of the serum. During cancerization the irregular oscillations give place to a slow and continuous ascension of the isoelec. point toward its max. value and there is established a new equil. different from the normal value.

L. W. RIGGS

Chemistry of cancerous tissue. (M.) AND (MME.) ENSELME. *Compt. rend.* 184, 1353-4(1927).—The object of this study was to learn what modification takes place in the chem. compn. of cancerous tissue following therapeutic irradiation by ultra-penetrant rays. In cancerous tissue there is a notable increase of nucleic P as compared with the healthy organ. Irradiation causes this excess of P to disappear, the irradiated cancer contg. the normal amt. of nucleic P. The lipidic P increases in the irradiated cancer and at the same time the proportion of fat; there appears to be a regression of nucleic compds. and a tendency for cancerous tissue to be transformed into fat. A particularly interesting point is that this evolution of neoplastic takes place only when irradiation has produced favorable therapeutic results.

L. W. RIGGS

The factors of mechanical decompression and biochemical hypo-oxygenation in the genesis of blood and pulmonary lesions in animals subjected to rarefied atmospheres. **RAOUL BAYEUX.** *Compt. rend.* **184**, 1356-8(1927).—Rabbits were exposed to rarefied air with and without the addn. of O. The results showed that the effects of rarefied air were due both to mech. conditions and to lack of O. The effects are additive, but are overcome by a subcutaneous injection of 250 cc. of O in a rabbit weighing 1.2 kg. This treatment is recommended in place of O inhalation which Richet and others have shown to be dangerous (cf. *C. A.* **21**, 2083). **L. W. RIGGS**

Seroflocculation by resorcinol and reaction of fixation; their comparative value as methods of diagnosis and prognosis of pulmonary tuberculosis. **V. GRYSEZ, R. PIERRET, LANGERON, A. BRETON and H. D'HOOR.** *Compt. rend. soc. biol.* **97**, 245 8(1927).—Seroflocculation by resorcinol has a high diagnostic value and a considerable prognostic value in pulmonary tuberculosis. It is superior in sensitiveness to the deviation reaction. **L. W. RIGGS**

The blood in suprarenal insufficiency. **G. VIALE and A. BRUNO.** *Compt. rend. soc. biol.* **97**, 261-3(1927).—In suprarenal insufficiency the blood loses plasma, perhaps by increased permeability of the vessels. **Lecithinases in suprarenal insufficiency.** **G. VIALE and T. COMBS.** *Ibid* 265 6.—The lecithinase activity is greatly diminished and often lacking in suprarenal insufficiency. **Suprarenal insufficiency and carbohydrates in the muscles of the dog.** **G. VIALE, S. M. NEUSCHLOSZ and TURCATTI.** *Ibid* 266-7.—Muscular glycogen in suprarenalectomized dogs is a little less than in normal dogs but it never disappears entirely. The lactacidogen always diminishes and after a certain time attains a value one-half that observed in normal animals. **L. W. RIGGS**

Edema and disturbances in the acid-base equilibrium. **MARCEL LABBÉ and É. AYERAD.** *Compt. rend. soc. biol.* **97**, 365 6(1927).—In 10 patients with edema it was not possible to establish any relation with the p_{H} of the blood or liquid of edema and the alk. reserve. It is believed that modifications of p_{H} in the interior of the cells is a factor in the pathology of edema. **L. W. RIGGS**

Blood groups of horses and adsorption of the red corpuscles. **R. DUJARRIC DE LA RIVIERE and N. KOSOVITCH.** *Compt. rend. soc. biol.* **97**, 373-6(1927).—Sufficient evidence was not found to show a relation between the blood groups and the antitoxic power of the serum. **L. W. RIGGS**

Cholesterol content of the serum of nursing infants in the course of disturbances in the alimentary canal. **M. MANICATIDE, A. BRATESCU and A. RUSescu.** *Compt. rend. soc. biol.* **97**, 391 3(1927); cf. *C. A.* **21**, 2727. —A study of 55 infants ranging from a few weeks to 18 months of age showed that the cholesterol content of the serum is not to be taken as an abs. prognostic factor in infantile dyspepsia. **L. W. RIGGS**

Condition of basal metabolism and of neuro-vegetative tonus in certain cases of hysteria. **PAULIAN PADÉANO and C. ARICESCO.** *Compt. rend. soc. biol.* **97**, 400-3 1927. Seven cases are reported. **Value of basal metabolism and condition of the neuro-vegetative tonus in certain cases of nervous maladies.** *Ibid* 403-4.—Eight cases are reported. **L. W. RIGGS**

Urinary lactic acid, ammonia and creatinine in Parkinson's disease. **J. FROMENT and L. VELLUZ.** *Compt. rend. soc. biol.* **97**, 490-1(1927).—A study of NH_3 and lactic acid elimination leads to the conclusion that Parkinson rigidity has its origin in acidosis. The findings with reference to creatinine confirm the conclusions of Koch, Marinesco and Popesco. **L. W. RIGGS**

Mechanism of inactivation of tetanic toxin by soaps and aliphatic acids (cryptotetanus). **P. SÉDALLIAN and L. VELLUZ.** *Compt. rend. soc. biol.* **97**, 496-8(1927).—Detailed explanations are proposed. **L. W. RIGGS**

Tetanic toxin and adrenaline of the suprarenals. **G. MOURIQUAND, A. LEULIER and P. SÉDALLIAN.** *Compt. rend. soc. biol.* **97**, 500(1927).—Acute or chronic tetanic intoxication does not appear to affect the adrenalinogenic function of the suprarenal gland and differs in this respect from diphtheritic intoxication which causes a notable diminution in the adrenaline content. After recovery from an exptl. tetanus the suprarenal medulla does not retain any disturbance in its functioning. During a subacute diphtheritic intoxication there is a diminution in the proportion of adrenaline. **L. W. R.**

A new serologic test for kala-azar. **L. E. NAPIER.** *Indian Med. Gaz.* **62**, 362-5 1927. The test is performed by adding 2 drops of a 24-hr.-old serum to 2 cc. of a 0.2% soln. of urea stibamine (Stiburea brand), or 2 drops of freshly sepd. serum to 2 cc. of a 1% soln. of stibamine, agitating and allowing to stand 10 min. If the serum is from a kala-azar patient a heavy flocculent ppt. seps., leaving the liquid clear. **L. W. RIGGS**

Carcinoma of the islands of the pancreas. Hyperinsulinism and hypoglycemia. RUSSELL M. WILDER, FRANK N. ALLEN, M. H. POWER AND H. E. ROBERTSON. *J. Am. Med. Assoc.* **89**, 348-55 (1927). — In a case of cancer originating in the islands of Langerhans, hourly doses of glucose were required to prevent convulsions from spontaneous hypoglycemia. When the ingestion of the necessary sugar was delayed the blood sugar fell below 0.03%. The blood phosphates fell with the sugar and rose again on the restoration of the blood sugar. The liver functioned normally in deaminizing amino acids and excreting bile and test dyes, but the glycogen stores proved abnormally stable to the action of adrenaline. Alkaloids from cancer tissue in the liver acted like insulin on injection into rabbits. L. W. RIGGS

Theory of cancer causation. ELLICE McDONALD. *Med. J. Record* **125**, 795-7 (1927). *J. Am. Med. Assoc.* **89**, 824. Speculative. L. W. RIGGS

Effect of tubercle bacilli and the chemical fractions obtained from analysis on the cells of the connective tissue in rabbits. FLORENCE R. SABIN AND CHARLES A. DOAN. *Proc. Natl. Acad. Sci.* **13**, 552-4 (1927). — Two specimens of water-sol. proteins, 304 and 903, and 2 phosphatide fractions, A 3 and A 4, from the labs. of Johnson and Anderson, Yale Univ., were tested with rabbits. The protein fractions were given intravenously in satd. aq. soln. These fractions are toxic, are associated with a damage to the endothelium producing hemorrhage and give a pressor effect on elastocytes. The phosphatide fractions were given intraperitoneally in the form of an emulsion. These are non-toxic but cause a local production of typical tuberculous tissue. L. W. R.

Plasma calcium. W. R. TWEEDY AND S. B. CHANDLER. *Science* **66**, 194 (1927), cf. *C. I.* **21**, 2112. The findings indicate that the thyroparathyroidectomized rat is much more responsive to the calcium principle than the normal albino rat. This is contrary to the conclusions of Collip from expts. with dogs. L. W. RIGGS

H--PHARMACOLOGY

A. N. RICHARDS

Histologic study of resorption and elimination of tellurium. C. LEVADITI AND O. DIMANESCO-NICOLAI. *Compt. rend. sci. Biol.* **95**, 149-64 (1926). — Te, like Bi, when administered intramuscularly undergoes progressive dissolution *in situ* through the formation of protein metallic derivate in which the element Te is found. It is absorbed in this form by the cells of the reticulo-endothelial system, the cytoplasm and mitochondrial network of which bring about a partial intracellular reduction. The other elements belonging to the same system phagocytize and transform the injected Te directly. It is in this dissolved form that the Te is carried through the body and comes in contact with the lymphoid organs, which fix and reduce it, and with the *Trepennia* on which it has a parasitocidal effect. The kidney secretes it as it secretes urates in birds, only the epithelium of the convoluted tubules and the ascending loop of Henle undertaking the secretion. The mitochondrial network of the epithelium seems to play an important part in this metal elimination process which does not seem to affect in any way the function of the kidney. This agrees with the statements of Lacazeigne, Latta and Levaditi concerning the localization of Po in the region of the renal cortex, all permitting a better understanding of the mechanism of elimination of metal. M. BEBER

Chronic meat intoxication* in Eck's-fistula dogs. S. A. MATTHEWS. *Am. J. Physiol.* **76**, 219-20 (1926). — An increase of NH_3 in the blood was found. In chronic meat intoxication one of the first results is gastric atonicity, followed by putrefaction of stomach contents. This is when the NH_3 content of the blood is highest. After emesis and gastric lavage, the high NH_3 drops and signs of intoxication disappear. The urine in Eck's fistula dogs is generally alk. with a tendency for the deposition of phosphates in the kidneys and tubules. J. B. BROWN

The inhibition of photodynamic phenomena. G. PENNETTI. *Arch. sci. biol.* **9**, 398-404 (1927). — It is known that eosin, when added to adrenaline soln. and the mixt. exposed to the sun, inactivates the adrenaline. Various substances were added to eosin adrenaline solns. to prevent this loss of activity in the adrenaline. Gelatin, egg albumin, glucose, Witte peptone, pyrogallol, hydroquinone and resorcinol were tried. Only the phenols were partially effective in preventing inactivation. A. W. C.

The action of insulin. G. QUAGLIARIELLO. *Arch. sci. biol.* **9**, 459-80 (1927). — A review. A. W. CONTIERI

The influence of light upon tuberculin. I. W. HAUSMANN, W. NEUMANN AND K. SCHUBERTH. *Z. Tuberk.* **46**, 32-6 (1926). — High dilns. of tuberculin are markedly weakened or made inactive by intensive exposures to the quartz lamp insofar as their

intracutaneous reacting power is concerned. Concd. tuberculin solns. are resistant to the action of light. The action is due to the short wave lengths (325 millimicrons).

H. J. CORPER

The relations of experimental pharmacology to chemical science. H. H. MEYER. *Ber.* **60B**, 21-36 (1927).—An address

E. J. C.

Action of new bismuth preparations (Heyden "564b" and "590") on dogs. JOSEPH LINGEMANN. *Deut. tierarztl. Wochschr.* **34**, 313-4; *Chem. Zentr.* **1926**, II, 456.—Administered *per os*, the prepn. "564b" was tolerated by dogs in quantities not exceeding 2 g. With subcutaneous administration, however, both "564b" and "590" were disproportionately poisonous, the doses tolerated by dogs per kg. of body wt. being 0.003-0.004 g. of "564b" and 0.002-0.003 g. of "590"

C. C. DAVIS

The distribution of bismuth in the animal organism after intra-muscular injection of 540D (vet.). OTTO MISEKE. *Deut. tierarztl. Wochschr.* **34**, 375-6; *Chem. Zentr.* **1926**, II, 456.—The expts. were carried out on rabbits with the Bi prepn. "540D." All the organs and the places of injection were examd. After injection of 1 cc. of "540D" (0.007 g. Bi), the kidneys had a high Bi content, the liver, intestine and stomach had less quantities. The other organs, as well as the blood, urea and feces, contained no Bi. The elimination of Bi began at the same time with its resorption. With Aubry reagent, a soln. of l-quinine, Bi can be detected when only 0.000002 g. per cc. is present. On addn. of Cd and pptn. in acid soln., the Bi can be quant. pptd. and Fe removed

C. C. DAVIS

The therapeutic activity of salts of acetylsalicylic acid. OSKAR NEMETZ. *Wiener Med. Wochschr.* **39**, 422; *Chem. Zentr.* **1926**, II, 282.—Ca acetylsalicylate, manufactured by Gelelon Richter as "Kalmapyrin," was used in place of aspirin, hypopyrin and other salicylates, with success in almost every case. It has the great advantage of not having a disturbing effect on the heart action and the circulation.

C. C. DAVIS

History and development of homeopathy. CLARENCE BARTLETT. *J. Am. Inst. Homeopathy* **20**, 759-77 (1927). Contains a concise summary with bibliography of Samuel Hahnemann's contributions to chemistry, toxicology and pharmacy.

JOSEPH S. HEPBURN

Therapeutic action of some bismuthyl derivatives of organic hydroxy acids. C. H. BROWNING, J. B. COHEN, R. GULBRANSEN, E. PHILLIS AND W. R. SNODGRASS. *Proc. Roy. Soc. (London)* **B102**, 1-9 (1927).—A series of 24 bismuthyl derivs. of org. hydroxy acid. was prepd., by reaction between the parent org. compd. and $\text{Bi}(\text{NO}_3)_3$ in soln. in AcOH . Their therapeutic action was tested on mice infected with *Spirochaeta pallida*. The org. constituent of the mol. apparently played a part in the detn. of therapeutic efficiency, since cures were effected only by the BiO derivs. of saccharic, gluconic, lactobionic, tartaric and citric acids. When bismuthylsaccharic acid was administered to 17 human subjects as 10% aq. suspension with an av. dose of 2.5 g. 5 to 10 doses at weekly intervals, an antisyphilitic action was noted insofar that the lesions healed in 12 cases, local irritation at the point of injection and slight poisoning by Bi occurred in many of the patients. The Na salt was tolerated distinctly less than the free acid. Bismuthylgluconic acid, administered intravenously or intramuscularly as a 10% aq. soln., had a marked antisyphilitic action.

JOSEPH S. HEPBURN

The effect of thyroid medication in nephrosis. SHIH-HAO LIU. *Arch. Internal Med.* **40**, 73-9 (1927).—In 2 cases thyroid medication caused disappearance of edema, reduction of albuminuria and subjective improvement. The rise of basal metabolism was associated with a decrease of blood cholesterol and an increase of serum proteins. The conclusion that nephrosis depends on hypothyroidism is, however, not warranted.

MARY JACOBSEN

Poisonous principles from Chinese rhododendron, Nao-yang-hua, Rhododendron sinuwellianum. TSAN-QUO CHOU. *Chinese J. Physiol.* **1**, 157-60 (1927); *Ber. ges. deutsch. exptl. Pharmakol.* **40**, 751.—Description of andromedotoxin which has been recently isolated by Hardikar and Plugge from *Andromeda japonica* and *Rhododendron sinuwellianum*. It is probably identical with Eykman's asebotoxin.

MARY JACOBSEN

Effect of morphine and quinine on the blood gases and their relation to internal secretions. E. MIYAKE. *Folia endocrinol. japon.* **2**, 4-5, 57-86 (1926); *Ber. ges. deutsch. exptl. Pharmakol.* **40**, 266.—In rabbits a dose of morphine decreases the CO_2 capacity of the blood, while the O_2 dissoxn. curve is unaltered or lowered. CO_2 content and capacity are increased by continuous oral administration of 5-10 mg. quinine. H_2O and lowered by 50 mg. When the drug habit is formed, the CO_2 content only is increased. The effect of the drugs on the CO_2 tension is lowered by thyroidectomy or castration and returns to normal on thyroid feeding.

MARY JACOBSEN

Effect of insulin on fat content of body and organs. S. OMURA AND K. NITTA.

Folia endocrinol. japon. **2**, 103-21(1927); *Ber. ges. Physiol. exptl. Pharmacol.* **40**, 383.—Rabbits respond to insulin injections with a fat increase in heart, kidney and skeletal muscle and a tendency toward fat decrease in the liver. Insulin-glucose increases the fat content of all organs. In mice insulin alone or with glucose gives rise to a general fat increase. The function of insulin therefore consists in glucose oxidation and glycogen and fat synthesis.

MARY JACOBSEN

Mutual antagonism of novocaine and caffeine. MINORU SHINAGAWA. *Folia pharmacol. japon* **3**, 340-6(1926); *Ber. ges. Physiol. exptl. Pharmacol.* **40**, 213.—Expts. on the rabbit uterus and the femoral vessels of the frog indicate that the prevention by novocaine of the muscle rigidity produced by caffeine is based not on a direct chem. reaction between the 2 compds. as assumed by Schuller, but on a physiol. process.

MARY JACOBSEN

The synergism between the local anesthetics of the cocaine group and potassium. JÔRÔ KAWABATA. *Folia pharmacol. japon.* **4**, 16-34(1927); *Ber. ges. Physiol. exptl. Pharmacol.* **40**, 456; cf. *C. A.* **21**, 3234.—The anesthetic effect of cocaine (I) and β -eucaine (II) on the sensory and motor endings of the frog sciatic and on the sensory app. of frog and guinea pig-skin and the action of novocaine (III) on the sensory app. is considerably enhanced by K. The skin anesthesia produced by KCl is intensified by minute quantities of I, II and III, which alone would be ineffective. KCl is the more powerful synergist. When KCl is given simultaneously with *tropacocaine*, *alpyne* and *stovaine* only a summation of effects is observed. **The synergism of cocaine and ammonium, calcium, strontium, barium and magnesium.** *Ibid* 35-57.—The cocaine anesthesia of the motor endings of the frog sciatic and of the sensory app. of the frog and guinea-pig skin is powerfully increased by K, NH_4 , Ca, Sr, Ba, the effect decreasing in the above order. The cocaine anesthesia of the sensory endings of the frog sciatic is similarly intensified by KCl and NH_4Cl . Cocaine is a (less powerful) synergist of the 5 salts with regard to skin anesthesia. The effects of cocaine and Mg are merely additive.

MARY JACOBSEN

The relation between the effect of adrenaline and the site of its injection. MASAHARU OGAWA. *Folia pharmacol. japon.* **4**, 64-75(1927); *Ber. ges. Physiol. exptl. Pharmacol.* **40**, 453.—The min. pressor dose is 0.001 mg./kg. rabbit intravenously (I) and about 0.5 mg. intramuscularly, subcutaneously or intraperitoneally. The effect is distinct but transitory in I, while the other modes of injection produce a slight but more lasting effect. When introduced into the gastrointestinal tract adrenaline is rapidly detoxified by the liver. The min. pressor dose *via* the small intestine is 6 mg., while intrastomachally 10 mg. has no effect. Rectally 2 mg. produces a noticeable and lasting effect, probably because the hemorrhoidal veins enter directly into the *vena cava* and thus withdraw part of the poison from hepatic circulation. M. J.

The detoxifying effect of the liver on cocaine. KIICHI KUSAKA. *Folia pharmacol. japon.* **4**, 79-96(1927); *Ber. ges. Physiol. exptl. Pharmacol.* **40**, 456.—Cocaine is detoxified chiefly in the portal circulation not in the liver.

MARY JACOBSEN

Effect of cocaine on hepatic and femoral vessels. KIICHI KUSAKA. *Folia pharmacol. japon* **4**, 97-100(1927); *Ber. ges. Physiol. exptl. Pharmacol.* **40**, 456.—Low concns. have a vasodilator, higher ones a vasoconstrictor, effect on the femoral vessels of the rabbit. Vasodilation on perfusion from either the portal or hepatic artery is hardly noticeable. Vasoconstriction in the portal region is insignificant although the vessels show considerable dilatation on subsequent washing with Ringer soln. M. J.

Pharmacology of aristolochine. KANSIJA RYO. *Folia pharmacol. japon.* **4**, 123-31(1927); *Ber. ges. Physiol. exptl. Pharmacol.* **40**, 462.—Aristolochine, $\text{C}_{22}\text{H}_{22}\text{N}_2\text{O}_3$, isolated from *Aristolochia debilis*, causes cardiac and respiratory paralysis in frogs and mice, an As-like intestinal inflammation in dogs and an alon-like hemorrhagic nephritis in rabbits. The pressor effect and the increase in respiratory rate and vol. (rabbits) are not influenced by vagotomy or atropine. The frog heart is first stimulated and then paralyzed; peripheral vessels are strongly constricted. Skeletal muscle is excited by small, paralyzed by large, doses. Smooth and earthworm muscles are acted upon directly.

MARY JACOBSEN

Pharmacology of toad venom. I. A toxic substance from toad liver. KANSIJO RYO. *Folia pharmacol. japon* **4**, 132-43(1927); *Ber. ges. Physiol. exptl. Pharmacol.* **40**, 463-4.—A substance with the pharmacol. action of Handovsky's *bufotenine* was obtained by triturating toad liver with quartz sand and 96% alc., dissolving in water and extg. with ether.

MARY JACOBSEN

Detoxification experiments with an antagonist. SHIGERU UCHIDA. *Folia pharmacol. japon.* **4**, 144-55(1927); *Ber. ges. Physiol. exptl. Pharmacol.* **40**, 459.—Atropine subcutaneously prevented 90% acetylcholine, 67% physostigmine, 30% pilocarpine,

25% ergot and 32% adrenaline deaths, the latter only when given in large doses. With regard to digitoxin, atropine showed an additive rather than an antagonistic effect.

MARY JACOBSEN

Influence of physical and pharmacological factors on the action of curare. I. Effect of temperature. SRIJI HORI. *Folia pharmacol. japon.* 4, 195-204(1927); *Ber. ges. Physiol. expll. Pharmacol.* 40, 457.—The effect of curare on the motor nerves of the frog increases with the temp. between 10° and 41°, while at low temp. the contrary is the case. The min. paralyzing doses were: 0.05 mg./10 g. frog at 2°, 2.5 at 10°, 0.5 at 20°, 0.1 at 30° and 0.025 at 41°. Both sensitivity of the nerve endings and reaction velocity seem to increase with the temp. **II. Effect of acids and alkalis.** *Ibid* 205-15.—The effect of curare is intensified by NaOH and inhibited by HCl in concns. identical in themselves. This is attributed to a change of reaction of the body fluids which detrs. the liberation of the curare base as well as the sensitiveness of the nerves.

MARY JACOBSEN

The effect of narcotics on convulsions caused by various poisons. EKIZO KOBAYASHI. *Folia pharmacol. japon.* 4, 233-46(1927); *Ber. ges. Physiol. expll. Pharmacol.* 40, 455.—Chloral hydrate, urethan and NaBr check strychnine (I) and picrotoxin (II) convulsions, but have no effect on physostigmine (III) convulsions. Morphine stimulates I and II and to a certain degree also III. Atropine, hyoscyamine and scopolamine aggravate II, inhibit III and have no effect on I.

MARY JACOBSEN

Treatment of amebal dysentery with emetine, yatren and stovarsol. P. B. VAN STEENIS. *Geneeskund. Tijdschr. Nederland. Indië* 67, 347-57(1927).—Emetine-HCl is still indispensable. It prevents relapses by sterilization of the entire body with regard to the histolytic form of *Amoeba tetragena*. Yatren is in most cases very effective especially against the minute forms and cysts. It is non-toxic, not cumulative and particularly useful for the treatment of emetine fast cases. An unpleasant collateral effect is the diarrhea. Stovarsol gave good results especially against minute forms and cysts, but less so than emetine and yatren. Toxic effects were not observed. M. J.

Treatment of tropical (amebal) liver abscess. P. B. VAN STEENIS. *Geneeskund. Tijdschr. Nederland. Indië* 67, 358-68(1927).—Emetine-HCl alone, 60 mg. daily or in combination with yatren (3 g. daily for 2 weeks) makes the clinical symptoms disappear. The blood picture improves gradually. It follows from the literature that emetine-stovarsol has a similar effect. Yatren or stovarsol alone is ineffective. M. J.

Blood sugar, adrenaline and sympathetic nervous system. A test for the excitability of the sympathetic. I. J. DELBAERE. *Nederland. Maandschr. Geneeskunde* 14, 119-120(1927).—The hyperglucemic effect of adrenaline is used as a test for the excitability of the sympathetic. After a theoretical discussion the results of tests are given: The hypodermic or intramuscular injection of 0.001 cc./kg. 0.1% adrenaline immediately after a meal rich in carbohydrates increased the blood sugar of normal children by at least 0.1% within 1/2 hr. after the injection. The response was less pronounced in convalescents from severe infections, esp. those with high fever, and in children suffering from acute nutritional disturbances (decompensation Herter's infantilism), exudative diathesis, or acute rickets with or without tetany. Although it seems established that the vagus has no part in the production of hyperglucemia a few expts. in this direction were made. The slightly antagonistic effect of histamine is attributed to an inhibition of the sympathetic rather than to a stimulation of the vagus. Atropine had a slightly synergistic effect.

MARY JACOBSEN

Effect of camphor on blood pressure. RYUZO KATAGI. *Okayama Igakkai Zasshi* 1927, 111-22; *Ber. ges. Physiol. expll. Pharmacol.* 40, 747.—In rabbits the subcutaneous injection of camphor has none or a varying effect on blood pressure. A rise in pressure is prevented by section of the *plexus lumbosacralis*. Intravenous injections always raise the pressure especially when it was artificially lowered. An injection into the jugular vein is more effective than one into the femoral. The effect is attributable to stimulation of the vasomotor centers, since it may be prevented by section above the spinal cord.

MARY JACOBSEN

Clinical study of the substance A of insulin. MARCEL LANDSBERG. *Progrès méd.* 55, 242-5(1927); *Ber. ges. Physiol. expll. Pharmacol.* 40, 601.—In diabetics the blood sugar dropped from its original value of 0.159-0.362 to 0.07-0.262 within 90 min. from the subcutaneous injection of 1.2 mg. of Funk's substance A. The decrease was independent of the original sugar level. The effect produced by 20 units of Burroughs-Wellcome insulin was but slightly greater. Oral administration is ineffective. Five out of 6 normal persons responded with a slight hyperglucemia. Marked hypoglycemia was produced in a case of doubtful pancreatitis. Six mg. promptly relieved coma. Shock did not occur in 2 cases of marked hypoglycemia. M. J.

Remarks on M. Landsberg's clinical study of the substance A of insulin. CASTMIR FUNK. *Progrès méd.* **55**, 245(1927); *Ber. ges. Physiol. exptl. Pharmacol.* **40**, 602.—L.'s results (preceding abstract) are confirmed by 25 clinical cases. The substance A is activated by co-insulin (substance C). In the normal person A and C are exactly balanced so that introduced A remains ineffective. The therapeutic availability of A on a larger scale depends on the isolation of C. The relative activity of insulin and of A is not definitely established.

MARY JACOBSEN

Copper in medicine and industrial pathology. VINCENZO MAZZI. *Rass. clin. terap. sci. affini* **26**, 163-79(1927).

MARY JACOBSEN

Calcium in the therapy of essential hypertension. AFFONSO MACDOWELL. *Rev. brasil. med. pharm.* **3**, 33-40(1927). In 6 cases surprisingly good results were obtained with 10% CaCl_2 every 12-24 hrs. Review of literature.

MARY JACOBSEN

Effect of a few poisons acting on the autonomous system on the changes of arterial pressure and respiration caused by ethyl alcohol. G. DI MACCO AND G. SORTINO. *Riv. patol. sper.* **1**, 470-3(1926); *Ber. ges. Physiol. exptl. Pharmacol.* **40**, 741.—Small quantities of EtOH raise the blood pressure through vasoconstriction in the splanchnic region. The rate of respiration is increased. The effect of alc. is enhanced by an increase of sympathetic tonus (atropine, cocaine). Both blood pressure and rate of respiration are lowered when the tonus of the vagus is increased (pilocarpine, picrotoxin, ergotoxin). Nicotine has no effect.

MARY JACOBSEN

Nerve lesions in experimental lead poisoning. JOSÉ MARIA DE VILLAVEDE. *Trav. lab. recherches biol. Madrid* **24**, 1-52(1926). The late nerve lesions in experimental lead poisoning. *Ibid.* 155-79; *Ber. ges. Physiol. exptl. Pharmacol.* **40**, 712-3.—Detailed description of lesions following daily subcutaneous injections of 1% Pb acetate in rabbits.

MARY JACOBSEN

Effect of insulin on blood glucolysis in vitro. R. GONZALEZ BOSCH. *Trabajos publ. clin. Pedro Escudera* **2**, 441-4(1926); *Ber. ges. Physiol. exptl. Pharmacol.* **40**, 405-6. The blood glucolysis in diabetics before and after insulin administration is the same as in normal persons.

MARY JACOBSEN

The protective action of caffeine. A. LJUBUŠIN. *Zurnal eksperim. biol. mediciny* **4**, 438-45(1926); *Ber. ges. Physiol. exptl. Pharmacol.* **40**, 459.—Caffeine increases the resistance of the frog heart to diphtheria toxin.

MARY JACOBSEN

Tellurium, new element with curative value in syphilis. C. LEVADITI, in collaboration with M. and MME. NICOLAU and MILE Y. MANIN. *Ann. inst. Pasteur* **41**, 364-442(1927).—Te injected into the rabbit in the state of the reduced element has a rapid curative action on exptl. syphilis and spontaneous spirochetosis. The therapeutic properties of Te bivalent, Te trioxide and quinine iodo-tellurate are almost equal to that of the free element. The sol. salts of Te, particularly TeO_3Na_2 and TeO_3K , are more toxic and less efficacious. The aromatic derivs. of Te, such as diphenyl Te, seem to have no curative effect, and are poorly absorbed after intra-muscular injection. A cyclic compd., 4-thyleyclofollurium-pentanediene, has weak therapeutic properties.

E. R. LONG

Tellurium in the treatment of human syphilis. L. FOURNIER, C. LEVADITI AND L. GUÉNOT. *Ann. inst. Pasteur* **41**, 443-57(1927); cf. *C. A.* **21**, 1845.—Te has a marked therapeutic effect upon human syphilis as shown by clinical observation and change from positive to negative in the Wassermann reaction. The action is not so rapid, however, as with As and Bi. There are certain disadvantages in the use of Te which for the present preclude its routine clinical employment, viz. bluish discoloration of the skin, tendency to cause slight loss in weight, pain and slight swelling on injection, slight febrile reaction, discoloration of the hair and the production of a disagreeable odor in the expired air. Toxic manifestations of importance are not caused by the injection, and the only effect on the kidneys is a slight polyuria of 1 and 2 weeks' duration.

E. R. LONG

The influence of dipping in solutions of arsenic upon the course of trypanosomiasis. L. E. W. BEVAN. *Rhodesia Agr. J.* **24**, 163-90(1927).—The expts. were inconclusive but indicate that trypanosomes can be held in check by frequent dipping of the animal in arsenical solutions.

A. L. MEHRING

Insulin and glycogen formation. K. POGÁNY. *Biochem. Z.* **187**, 72-7(1927).—Expts. on mice indicate that glycogen storage occurs under the influence of insulin and in such a way that the formation varies directly with the dose of insulin administered. If, however, the insulin treatment leads to cramps the formed glycogen is used up in the muscles.

S. MORGULIS

The relation of chemical, colloidal and biological effects of Röntgen rays of differ-

ent wave lengths to the ionization which they produce in air. I. Action of Röntgen rays on solutions of oxyhemoglobin in water. HUGO FRICKE AND B. W. PETERSEN. *Am. J. Roentgenol. and Radium Therapy* 17, 611-20(1927).—A soln. of oxyhemoglobin prepd. from rabbits' blood, approx. $\frac{1}{2} \cdot 10^{-4}$ N in respect to hemoglobin, was irradiated with 3 types of x-rays, giving homogeneous rays of wave lengths 0.248 Å U., 0.527 Å U., and 0.754 Å U. The oxyhemoglobin is transformed to methemoglobin and perhaps other substances. The 2 longer wave-length radiations have the same effect, while the shortest produces a slightly greater effect for the same dose, as measured by the ionization produced in air. EDITH QUIMBY

The skin erythema dose with a combination of two types of radiation. EDITH H. QUIMBY. *Am. J. Roentgenol. and Radium Therapy* 17, 621-5(1927).—The dose required to produce an erythema on human skin was detd. for 2 types of radiation, one purely γ , the other about 70% β , 30% γ , when a treatment consisting of half of each of these doses was administered, no erythema resulted. It was necessary to use $\frac{1}{2}$ of a dose of each in order to produce the same skin effect as one full dose of either. EDITH QUIMBY

The causes of the destruction of cholesterol in vitro by Röntgen irradiations. R. P. MACFARLANE AND A. BACHE. *Am. J. Roentgenol. and Radium Therapy* 18, 150-1(1927).—Cholesterol in different solvents was irradiated with x-rays under the following conditions: 170 kv., 20 ma., 12 in. distance, 20 min. exposure, one black paper as light filter. Destruction resulted only with CHCl_3 and CCl_4 . The effect is an indirect action due to the formation of oxidizing substances, probably the oxy acids of Cl. EDITH QUIMBY

The use of colloidal lead in the treatment of cancer after the method of Blair Bell. Preliminary report. H. J. ULLMANN. *Radiology* 8, 461-5(1927). The cancer problem with reference to recent developments. M. J. SITTENFIELD. *Ibid.* 465-9. The metallic colloids in the treatment of cancer, a preliminary report. ALBERT SOLAND, W. E. COSTLOW AND O. N. MELAND. *Ibid.* 469-74. These three papers and the accompanying discussion constitute a symposium on the present status of the treatment of cancer by intravenous injection of metallic colloids. EDITH QUIMBY

Excitability and contractility of the muscle of the frog as a function of the calcium chloride content of the perfusing liquid. J. P. BOUCKAERT AND J. COLLE. *Compt. rend. soc. biol.* 96, 434-7(1927). The influence of changes in the CaCl_2 content of the perfusing liquid upon contractility, rheobasis and chronaxie was detd. and was illustrated by curves. Excitability was shown better by the rheobasis than by chronaxie. This result is analogous to that obtained by Buchanan and Garven (*J. Physiol.* 62, 190-200) in their study on chronaxie in parathyroptoxic tetany. L. W. RIGGS

Action of insulin on glucose in vitro. T. J. C. COMBES. *Compt. rend. soc. biol.* 97, 268-70(1927).—Insulin does not transform α or β glucose into γ glucose in vitro, nor does it accelerate the stabilization of glucose. The rotatory power of a soln. of glucose is not diminished in the presence of muscle of the guinea pig, and the reducing power remains the same. Insulin does not modify the rotatory power. A diminution of the rotatory power is due to the presence of levogyrous substances which dialyze and which are adsorbed by animal charcoal. L. W. RIGGS

Effect of insulin and glucose on the oxygen utilization of the surviving spinal cord of frogs. H. J. WOLF. *Arch. ges. Physiol. (Pflüger's)* 216, 322-36(1927).—The O₂ of the cord of summer frogs is not modified by insulin alone (that of winter frogs but slightly changed) nor by glucose alone if the cord is not artificially stimulated. However, the cord is damaged or is that of a sick animal, glucose addn. may cause a considerable, though transitory, increase in O₂ utilization. When insulin is added to a cord in glucose soln. a definite and protracted increase in O₂ use follows, the effect depending on the concn. of insulin, high concns. being without effect or inhibitory. G. H. S.

Effect of atropine on the reaction of skeletal muscle to direct stimulation. W. H. HUBB AND J. BÜSCH. *Arch. ges. Physiol. (Pflüger's)* 216, 644-50(1927).—The behavior of the frog gastrocnemius intoxicated with atropine differs in several of its reaction phases from that of the normal muscle. G. H. S.

Relation of the action of thyroxin to the sympathetic nervous system. EMIL H. HUBB AND ERNST WERTHEIMER. *Arch. ges. Physiol. (Pflüger's)* 216, 697-707(1927).—The increased action of thyroxin due to a diet especially rich in protein is abolished by carbohydrate feeding, or by the parenteral administration of suitable doses of ergotamine. The latter given alone causes a fall in body temp. and an immediate reduction in the gas exchange. This increases again after a few hrs. and may

reach values above the normal level. With repetition of the treatments with ergotamine the effects become less marked. Apparently thyroxin acts upon the sympathetic. G. H. S.

Alkaloid of the seeds of *Nandina domestica* (TAKASE, OHASHI) 17.

1- ZOOLOGY

R. A. GORTNER

The amino nitrogen in the eggs of *Bombyx mori*. M. TIRELLI. *Arch. farmacol. sper.* 43, 115-28(1927).--In the freshly deposited eggs of the silkworm moth and in those kept over the winter the amino N is present in greater amt. than in the incubated eggs. Variations in amino N were noted in hibernating eggs. During incubation there is first a decrease and then an increase in amino N. Autolysis in the presence of PhMc also results in an increase, especially with eggs in the later stages of incubation. A. W. DOX

Study of the direct and indirect action of x-rays upon the tissues of the embryonic fowl. T. S. P. STRANGEWAYS AND HONOR B. FELL. *Proc. Roy. Soc. (London)* B102, 9-29(1927).--The degenerative changes produced in the tissues of 6-day embryos by x-rays are intimately related to cell metabolism; the lethal action of the rays is due, not to the formation of stable toxic products, but, in part at least, to the absence of gaseous exchange in the tissues, possibly as a result of intravascular clotting of the blood. JOSEPH S. HEPBURN

The tubes of *Spirographis spallanzani*. Discovery of a supporting substance which is a conjugated hydroxyamino acid and sulfuric acid. SIGMUND FRANKEL AND CURT JELLINEK. *Biochem. Z.* 185, 379-83(1927).--The house tubes of *Spirographis* are made up of proteins which can be removed by peptic and tryptic digestion. The remaining undigested basic substance is a H_2SO_4 -ether combination with at least 3 amino acids, 2 tyrosyl groups and 1 arginine group. S. MORGULIS

Limulus polyphemus. SIGMUND FRANKEL AND CURT JELLINEK. *Biochem. Z.* 185, 384-8(1927).--The *Limulus* carapace, unlike the shell of crustacea, has no $CaCO_3$ deposit, and also contains a large amt. of protein (70%). The chitin is richer in C and poorer in N than the chitin of crustacea. S. MORGULIS

Dihydroxyphenylalanine in the cocoon of *Samia cecropia* L. (Saturniidae). HANS PRZIBRAM AND HANS SCHMALFUSS. *Biochem. Z.* 187, 467-9(1927).--3,4-Dihydroxyphenylalanine was isolated from cocoons of *Samia cecropia*. S. MORGULIS

Origin of the yellow color of beeswax. G. F. JAUBERT. *Compt. rend.* 185, 405-6(1927); cf. *C. A.* 21, 2509.--The m. p. of 1,3-dihydroxyflavone given by Picard (*Beilstein* 3, 628) as 275° is inexact; it should be 285° . It is suggested that the coloring matter of beeswax may be obtained from *Reseda luteola*, *Calluna vulgaris*, *Apium pectinatum*, etc., as well as *Populus nigra*, and that beside 1,3-dihydroxyflavone, small quantities of other derivs. of this coloring matter may be present. L. W. RIGGS

Action of metallic silver upon infusoria; sensitization by eosin. MARYVONNE HAMON. *Compt. rend. soc. biol.* 97, 340-2(1927); cf. Drzewina and Bohn, *C. A.* 20, 3316; 21, 750.--*Paramecia* lived without apparent difficulty in a culture contg. 1 in 500 of eosin. *Paramecia* from a culture contg. 1 in 100,000 of eosin when exposed to metallic Ag were dead in about 15 min., while control *Paramecia* not exposed to eosin lived about 2 hrs. With eosin at 1 in 10,000 the *Paramecia* when placed on Ag died in about 3 min. L. W. RIGGS

Ratio of carbon to nitrogen in the urine of certain mammals. R. VLADESCO. *Compt. rend. soc. biol.* 97, 393-5(1927).--In herbivora the ratio C/N averaged about 2.5, dog 1.06, cat 0.65 and man 0.88. The larger ratio in herbivora is attributed (1) to the greater proportion of cyclic org. compds. from the food which are not oxidized in the body but are eliminated by the kidneys, (2) the greater length of the intestine favoring more complete absorption, and (3) the vegetable foods contain K compds., which are eliminated in the urine as carbonates. L. W. RIGGS

Physical and chemical modifications of the plasma under the action of snake venom in vivo. J. J. ROSSINGROLL. *Compt. rend. soc. biol.* 97, 414-5(1927).--The venoms of *Lachesis alternatus* (1 mg.), *L. newwedri* (1 mg.) and *Naja tripudians* (1 to 3 mg.) were severally dissolved in 10 cc. of 0.9% NaCl soln. and were injected in 2 to 3 min. into the jugular vein of the dog. Each of these venoms caused a diminution of the surface tension, an increase in the viscosity and a diminution of the total proteins of the blood. The diminution of total proteins was especially marked with the venoms of the *Lachesis*. Fibrinogen was strongly diminished. The fraction of the blood precipitable as globulin was increased but that of albumin was diminished. Non-

protein N was increased. The variation in the proportions of globulin and albumin *in vivo* is inverse to that observed *in vitro*. Physico-chemical modifications of horse serum under the action of snake venom *in vitro*. *Ibid* 415-6.—Snake venom (1 mg. per cc. of serum) added to normal horse serum at 37° and under a layer of toluene produces an immediate opalescence, which after 24 hrs. becomes opaque. Except with venom of *Naja tripudians* there is a diminution in viscosity which progresses for 24 hrs., and varies with the proteolytic power of the venom and the dose used. This action is least at p_H 6.0 and is at a max. with a p_H between 6.46 and 6.48. It diminishes after 6.46 and becomes almost const. between 6.67 and 8.36. Venom of *Naja tripudians* increases the viscosity of the serum. The surface tension always diminishes. After 24 hrs. contact under toluene the f. p. of the serum is lowered. Non-protein N always increases. L. W. RIGGS

Egg of the mollusk *Voluta brasiliana* and its use as a dialyzing membrane. A. H. ROFFO AND L. M. CORREA. *Compt. rend. soc. biol.* 97, 420(1927).—The egg gives the reactions of keratin, and its alky. calcd. as $NaHC_2O_3$ is 0.21%. It contains dry substance 25.48%, mineral substances 16.0, org. substances 9.0, Cl as NaCl 13.70, SO_3 1.03, Ca 0.216. The membranes of these eggs have all the characters of semipermeable membranes and have been used as ultra-filters. L. W. RIGGS

Iron organisms. WM. J. MEEHAN AND L. BAAS-BECKING. *Science* 66, 42(1927).—A medium of tap water and Fe filings was favorable to the growth of *Toxothrix*, *Spirophyllum*, etc. of the *Gallionella* group. The occurrence of these organisms in the vicinity of Stanford Univ. appears to be related to the aeration of deep waters in which the aeration of the hydrotroilite black mud causes a formation of H_2S , while the oxidation of Fe goes parallel to an acidification of the aerated water, the p_H changing from 7.6 to 6.8. As soon as the p_H drops below 7.0 the black suspended hydrated pyrite begins to decompose. L. W. RIGGS

Biophysics of lower organisms. II. Specific weight and volume of *Naegleria*-Sp. HANS LEONTIEV. *Arch. ges. Physiol.* (Pflüger's) 213, 1-4(1926); cf. C. A. 20, 3701.—For *Naegleria* the sp. wt. was detd. as 1.045; for ameba, the wt. as $9.65 \cdot 10^{-8}$ mg. G. H. S.

12—FOODS

F. C. BLANCK AND H. A. LEPPER

Determination of benzoic acid in foodstuffs. G. W. MONIER-WILLIAMS. *Chemist & Druggist* 106, 351-2(1927).—An abstr. from Rept. No. 39, Public Health and Medical Subjects, Ministry of Health. A new method of detg. BzOH in fruit and vegetable products is based on the ready and complete distn. of BzOH with steam from a liquid acidified with H_3PO_4 and satd. with NaCl. Collect the vapor in *N* NaOH, evap. to a small bulk, oxidize the impurities with $KMnO_4$, ext. BzOH with a mixt. of Et_2O and petroleum spirit (b. 30-50°), evap., and resublime BzOH by the Polenske method, modified. Recovery of BzOH by this (tentative) method is satisfactory. S. W.

A bibliography for cookery investigation problems. VICTORIA CARLSSON. *Separate* 168 pp.) publ. by Bur. of Publications, Teachers College, Columbia Univ., N. Y. City (1927). F. J. C.

Dehydrated fruits and vegetables. F. T. SHUTT. *Dept. Agr. Canada, Rept. Dominion Chemist, Year Ending March 31, 1926*, 94-5(1927).—Data are given on the H_2O content of 5 varieties of fruit and 6 of vegetables before and after dehydration. The max. amt. of SO_2 found in dehydrated apples was 0.08 part per 1000 and in dehydrated peaches 0.3 part per 1000. K. D. JACOB

Storage and transportation diseases of vegetables due to suboxidation. R. NELSON. *Mich. Agr. Expt. Sta., Tech. Bull.* 81, 38 pp.(1926).—The results of the investigation of certain non-parasitic diseases affecting crucifers, lettuce and potatoes in storage and transportation are presented. These diseases include black leaf speck on crucifers, redheart of lettuce and cabbage and surface pitting of potato tubers. These diseases are symptoms of breakdowns that occur under present conditions of storage and transportation and are caused primarily by an inadequate supply of O_2 at low temps. which prevent the utilization of the O present. These breakdown diseases have been produced in the lab. under various conditions of temp. and air compn. and both of these factors are important in causation. Air movement without renewal has not been effective in preventing breakdown and at low temps. air composition appears to be less important than low temp. as a cause of these diseases. Surface

breakdown of potato tubers occurs in the absence of blackheart and may be produced by exposure to conditions less severe than is assumed to produce black heart. It is suggested that the ultimate cause of the blackheart is the liberation or accumulation in certain cells of some toxic material, possibly from the mixture of hydrolytic enzyme and glucoside. The conditions favoring this reaction are brought about in storage and transportation by prolonged exposure to low temp. or an inadequate O supply.

J. J. SKINNER

Maize by-products. W. L. DAVIS. • *Langston, Feeding Stuffs and Farm Supplies* J. 12, 43-10(1927). The composition and feeding value of corn by-products are discussed.

K. D. JACOB

Report of Committee on Standardization of the Experimental Baking Test, 1926-1927. I. General report and recommendation of "fixed type of procedure." M. J. BLISH. *Cereal Chemistry* 4, 299-302(1927), cf. C. I. 21, 2036. II. Comments on the proposed baking test. L. H. BAILEY AND EMILY GREWE. *Ibid* 303 5. III. Observations of baking tests. R. C. SHERWOOD AND C. H. BAILEY. *Ibid* 305 9. IV. Comments. C. B. MORRISON. *Ibid* 309 10. V. Comments. L. D. WHITING. *Ibid* 310.

L. H. BAILEY

The bleaching of flours. F. BORDAS. *Ann. fals.* 20, 413-20(1927).—From a discussion of the advantages and disadvantages of bleaching flours, B. concludes that, from the standpoint of the public health, consumption of bread made from bleached flour possesses nothing but drawbacks.

A. PAPINEAU-COUTURE

Heat-damaged wheat. D. A. COLEMAN AND R. E. ROTHGEB. U. S. Dept. Agr., *Tech. Bull.* 6, 1-31(1927). A study was made of the phys. characteristics and chem. compn. of heat-damaged and header-damaged wheat of different varieties, the effect of the damage upon yield and compn. of flour and the character of the resulting loaf of bread. The results show that the addition of 0.5% of badly heat-damaged kernels to sound wheat injures the milling and baking qualities of the sound wheat. Header-damaged wheat is also of inferior milling quality in that it gives a low yield of flour of high ash content and the resulting bread is of undesirable color and taste.

W. H. ROSS

Study of the simplified molecular constant (S. M. C.) of milks of the Somme. G. JORET AND R. RADET. *Ann. fals.* 20, 341-53, 493-11(1927), cf. Oubrè and Fournier, C. I. 18, 3233-4. Analyses of 196 samples of milk of herds and of individual cows, all of known purity, and of 11 samples of commercial milks are tabulated and discussed. The results indicate that 70 is a reasonable min. value for the S. M. C., but with milk of individual cows a tolerance of ± 1 is permissible. The S. M. C. is affected by the feeding of the cows, being lowered by oil cakes, and particularly by bran, presumably because of their high P.O. content which increases the sol. P.O. in the milk serum and correspondingly reduces the Cl content.

A. PAPINEAU-COUTURE

The relative values of reductase test and acidity for the evaluation of the hygienic condition of milk. W. H. PADMOS. *Nederland. Tijdschr. Hyg. Microbiol. Serol.* 2, 132-8(1927), cf. C. I. 21, 614. The min. reductase time should be 2 hrs. in summer and 4 in winter. Because of the long incubation period the acidity is not an adequate indicator of contamination or stability. In a series of 3115 summer samples the reductase time was less than 2 hrs. in 2.3%, while less than 1% had a pH below 8.

MARY JACOBSEN

Estimation of milk fat in milk chocolate by means of a modified xylene number. C. A. GREENLEAF. *J. Assoc. Official Agr. Chem.* 10, 396-101(1927).—A method is given for detg. a modified xylene no. on fats, consisting essentially in sapon. with glycerol-KOH, pptg. out the insol. Mg salts, red. by the filtrate, extg. the xylene-sol. acids, distg. the residual H₂O-sol. acids, and titrating the distillate. The technic is described in detail. Examn. of 12 samples of butterfat gave xylene nos. of 25.20-27.70 (av. 26.18), examn. of 6 samples of cacao butter gave 0.10-0.40 (av. 0.19). In mixts. of butterfat and cacao butter, when the xylene no. < 11.72 butterfat % = $\frac{\text{xylene no.} - 0.19}{0.288}$, and when the xylene no. > 11.72 butterfat % = $\frac{\text{xylene no.} - 2.08}{0.241}$.

0.241

Closely agreeing results were obtained in duplicate detns. and by 2 different analysts.

A. PAPINEAU-COUTURE

The degree of dispersion of fat in milk. H. H. WEIGMAN, JR. *Milchwirtschaft Forsch.* 4, 259-311(1927).—A series of tables give the variation in size of different breeds, also the distribution of various sizes, with vol. and wt. of fat in the various sizes.

G. R. GREENBANK

The bactericidal action of milk. K. DREWES. *Milchwirtschaft. Forsch.* 4, 403-30(1927).

G. R. GREENBANK

Some factors other than bacteria that influence the body of artificial buttermilk. GEORGES KNAYSI. *J. Agr. Research* **34**, 771-84(1927).—The quality of artificial buttermilk may be improved by the addn. of various Na salts to the milk before souring but the flavor of the product is altered by this treatment. Heating milk at 100° produces a marked improvement in the body of the product over heating at 82°. The tendency of artificial buttermilk to whey off when incubated at rather high temps. is due largely to phys. forces. Homogenizing artificial buttermilk results in the sepn. of serum and homogenizing milk before souring has no beneficial effects. Substances like gelatin and starch produce no improvement in the quality of the buttermilk when used under the conditions of the expts. W. H. ROSS

Composition of Danish butter and some methods of analysis. A. C. ANDERSON. *World's Butter Rev.* **1**, No. 4, 21-2(1927).—To prep. samples for analysis, the stirring method affords greater accuracy than the shaking method. It is quite impossible to take out 2 similar samples from the same parcel of butter, it never being altogether homogeneous. Fat is detd. by an indirect method, 100 - (% water + fat-free dry matter). The sum of water and fat content is fixed at 98.3% for salted butter and 99.1% for fresh butter by the indirect fat detn. method. The sum of water and fat content by direct detn. is at present 98.5% for salted butter, and 99.4% for fresh butter. The α is somewhat dependent on the season. The av. salt content in salted Danish butter is about 0.9%, in unsalted butter not more than 0.08%. If fat is detd. by the Gerber method, 0.5% is deducted from the value found. J. C. JORRGENS

Green color in butter. A. A. RAMSAY, A. M. BROWN AND H. H. RANDELL. *Agr. Res.* **1**, No. 3, 175-80(1927).—The development of green color in certain samples of butter appeared to be due to protein decompn. with formation of melanins. The green color was confined to butter from cows grazing on herbage infested with aphids and appeared to be restricted to butter produced by certain members of the herd. Pasteurization hastened development of the abnormal color. There was no definite correlation between the bacterial flora of the milk and the color of the butter. K. D. JACOB

Determination of iron in butter. G. SCHWARZ. *Milchwirtschaftl. Forsch.* **3**, 50-54(1926); *Ber. ges. Physiol. exptl. Pharmacol.* **40**, 350; cf. *C. A.* **9**, 1442. —S determination of iron in butter by a colorimetric method based on Chugaev's dimethylglyoxime reaction. Ca, Mg and H₂PO₄ interfere only when present in larger proportions. The rapid decompn. of milk which imparts to it a salty and metallic taste can be induced by a few mg. Fe. MARY JACOBSEN

The distribution of water in butter. HANS BOYSEN. *Milchwirtschaftl. Forsch.* **3**, 21-24(1927).—The distribution of water in butter is shown by photomicrographs of each parallel and crossed Nicol prisms. The disappearance of droplets, about salt crystals, is shown and accounted for. G. R. GREENBANK

Chemistry of cheese ripening. III. W. GRIMMER AND K. SCHUTTLER. *Milchwirtschaftl. Forsch.* **3**, 495-502(1926); *Ber. ges. Physiol. exptl. Pharmacol.* **40**, 646.—Caseoglutin, the alc. sol. protein of brick cheese, has been studied by Grimmer and Schuttler. The compn. of the new prepn. differs from the former and from paracaseoglutin. Caseoglutins are probably mixts. of S compds. and of S-free substances of varying tryptophan content, which are always higher than those of the original substance. Caseoglutin contained 1.0% histidine, 3.2 arginine, 13.4 lysine, 0.8 NH₂, 3.3 tryptophan, 1.0 alanine, 5.8 valine and leucine, 12.6 isoleucine, aspartic and glutamic acids, phenylalanine, 1.1 tyrosine and 1.9 proline. MARY JACOBSEN

The action of rennet. II. W. GRIMMER AND W. RUDZIK. *Milchwirtschaftl. Forsch.* **3**, 361-403(1926); *Ber. ges. Physiol. exptl. Pharmacol.* **40**, 727.—The expts. were carried out with the strongly acid Swiss Peptolab and 2 slightly acid German rennets, the p_H of which increased inversely with the enzyme concn. Grimmer and Rudzik's former expts. on war rennet were confirmed. The relation between $c \times t$ (enzyme concn. \times coagulation time) and c is represented by a logarithmic curve, the p_H of which tends to flatten with decreasing p_H . The factor is const. for the same p_H and, apart from a few inexplicable exceptions, independent of the p_H . In solns. containing 1 mg. rennet and 0.1 cc. 0.05 N HCl in 10 cc. $c \times t$ decreases with increasing c , the relation being represented by a logarithmic curve. In 0.1 N HCl $c \times t$ first increases with c , then decreases after having passed a max. at 20-30 mg. rennet. With const. p_H the curves differed from each other and from those obtained in aq. solns. only slightly. In phosphate solns. the p_H decreased with increasing c , while $c \times t$ followed a log. curve. The same was the case in a HCl soln. kept at p_H 4.8. On souring or addn. of acids t was a log. function of p_H . In a few cases the coagulation

velocity increased parallel with the acidity. Rennet is injured by the direct addn. of alk. salts.

MARY JACOBSEN

A study of metal foils and glazed paper as wrapping material for cheese. B. BLEYER AND K. MAYER. *Milchwirtschaft. Forsch.* 4, 312-35(1927).—A study of the changes occurring on the surface due to adsorption of metal or coatings on paper.

G. R. GREENBANK

Creatinine determinations in bouillon preparations. WILHELM MÜLLER. *Mitt. Lebensm. Hyg.* 18, 112-3(1927); cf. *C. A.* 20, 2375.—A comparison of the methods for creatinine according to Sudendorf and Lahrman (C. A. 9, 1948) and *Schweiz. Lebensmittelbuch* 3, 72(1917).

R. C. ERB

Effect of ethylene on the composition and color of fruits. E. M. CHACE AND C. G. CHURCH. *Ind. Eng. Chem.* 19, 1135-9(1927)—Ethylene treatment does not appreciably alter the compn. of citrus fruits but does accelerate the coloring. The same treatment hastened the coloring of persimmons, destroying the astringency and producing softening. Conclusive data on other fruits are not yet available.

R. C. E.

Fruit jellies. P. B. MYERS AND G. L. BAKER. Delaware Agr. Eng. Sta., *Bull.* 141, 14-9(1925); cf. following abstr.—Regardless of total acidity or presence of salts, the minimum point of jelly formation occurs at a p_H value of 3.50-3.55, values very close to Tarr's min. point. The optimum point of jelly formation varies between p_H 2.85 and p_H 3.30, depending upon the nature of the acid and salt used. Total acidity can vary over a wide range, depending upon the buffering power of the initial soln. from which jelly is made. The strength of the jelly, made by adding a salt to the pectin, acid, sugar soln., is dependent upon the initial p_H value of the soln. and the concn. of the salt.

E. F. SNYDER

Fruit jellies. IV. The role of salts. P. B. MYERS AND G. L. BAKER. Delaware Agr. Expt. Sta., *Bull.* 144, 3-35(1926); cf. preceding abstr.—The effects on jelly formation of variations in H-ion concn., salt concn. (total acidity const.) and salt concn. (H-ion concn. const.) were studied. The buffer action of fruit juices is largely due to the presence of salts in the juices. The quantity of acid that may be present in a juice of good jelling properties is dependent upon the buffer action of the juices. The H-ion concn. detcs. the jelling properties of a fruit juice rather than its acid content, other conditions being equal. The anion of the salt functions mainly as a buffering agent and may also function as a peptizing agent if present in sufficient quantities, thereby increasing the strength of jellies and preventing syneresis. The cation of the salt functions in a manner similar to that of the H ion of the acid, but only at definite H-ion concns. Syneresis in jellies may be caused by the H ion alone or by the H ion and cation of the salt together, but not by the action of the cation of the salt alone. Clear, sparkling jellies were obtained from pectin solns. contg. appreciable quantities of a salt, while cloudy and dull-appearing jellies otherwise resulted.

E. F. S.

Analysis of "fruit and apple" jams. (Estimation of the ratio of apple to "fruit.") C. F. MUTTELET. *Ann. fals.* 20, 391-4(1927).—The acidity of fruits contg. only citric acid is fairly const., with the following min. values: black currant 3.0, gooseberries 2.0, raspberries 1.0, strawberries 1.0% of the juice. Examn. of a large no. of different kinds of jams and jellies showed that on the av. they consist of about 64% added sugar (sucrose and invert sugar) and 36% "fruit" and apple or apple product (pomase, pectic juices, etc.). The proportion of "fruit" can be calcd. approx. from the citric acid, and apple, etc., by subtracting the "fruit" from 36%. Analysis of a no. of com. samples of "fruit and apple" jams showed little or no malic acid, indicating that the use of pectic juices is now current com. practice for this class of goods.

A. P.-C.

Glycerol substitutes. W. A. WHATMOUGH. *Chemist & Druggist* 106, 411(1927).—Concd. invert sugar sirup, being non-cryst. and non-fermenting, and in itself an excellent food, is recommended as a substitute for glycerol as a preservative of fruit juices. It far surpasses it by conserving the natural fruity taste. Addn. of honeys may affect the taste, and may also cause crystn. or fermentation. The concd. sirup must be used undild. with H_2O .

S. WALDBOTT

Apple wrappers. F. T. SHUTT. Dept. Agr. Canada, Rept. Dominion Chemist, Year Ending March 31, 1926, p. 94(1927).—Sulfite-paper wrappers contained the highest % of moisture, 11.6, and the lowest % of petroleum ether ext., 0.61. Wax-stripe paper wrappers contained the lowest % of moisture, 2.94, and the highest % of petroleum ether ext., 48.84.

K. D. JACOB

Correlation of nutritive value with dry matter content of pastures. E. J. SHEEHY. *Sci. Proc. Roy. Dublin Soc.* 18, 389-98(1927).—Two pastures which differed markedly in the botanical characters of their herbage were studied by lab. analysis and by feeding expts. with guinea pigs. The chem. compn. and digestibility of the dry matter was

practically the same for both pastures. The percentage of dry matter in the herbage was 25% higher in the pasture contg. closely packed grass, over the pasture contg. more clover and miscellaneous plants. This was the one definite factor of difference between the 2 pastures. Since nutritive value is roughly proportional to the dry matter content the latter may be taken as a measure of the value of pastures. L. W. RIGGS.

Wyoming forage plants and their chemical composition. VII. Effect of altitude, seasonal variation and shading experiments. E. N. ROBERTS. Wyoming Agr. Expt. Sta., *Bull.* 146, 35-89 (1926).—Western forage plants increase in feeding value with increase in altitude at which they are grown. Increase in altitude caused an increase in crude protein, in N-free ext. and caloric value. As the season advanced, the crude protein of the forage plants decreased and the N-free ext., ether ext. and crude protein increased. Shading caused an increase in crude protein and a decrease in N-free ext.

J. J. SKINNER

Composition of Arizona forages, with comparative data. C. N. CATLIN. Arizona Agr. Expt. Sta., *Bull.* 113, 155-73 (1925).—The data have been compiled from analyses made during the past 25 yrs. at this station. Appended tables show the compn. of forages, hays, silages, fodders, grains, miscellaneous feeding stuffs and the digestibility coeff. of feeding stuffs.

E. F. SNYDER

A method of improving the feeding value of straw-chaff. ALBERT HOWARD. *Agr. J. India* 22, 41 2 (1927).—Millet straw was converted into a satisfactory cattle food by fermenting for 35 days in mixt. with green corn and NaCl (cf. Jonas, *J. Roy. Agr. Soc. England* [2], 6, 119 (1870)).

K. D. JACOB

Preservation of young green fodder. II. K. SCHMIDT. *Leopoldina* 2, 107-16 (1926); cf. *C. A.* 20, 3050; 21, 2748.—Lab. and large-scale expts. were made on the effect on the compn. of lucerne silage of evacuating the silos after filling and then introducing CO₂ or CS₂ vapor. Feeding expts. with sheep and cows showed that the silage made in this way gave satisfactory results. In the lab. expts., the formation of butyric acid was entirely suppressed. Treatment with CS₂ also reduced the amts. of acetic acid and NH₃ produced. Samples of the gases in the silos were analyzed at intervals. There was a markedly greater production of H in the silage treated with CO₂ than in that treated with CS₂; and, in the large silo, an increased amt. of H in the lowest layer. Temp. changes and the rate of formation of acids in the silage are also discussed.

B. C. A.

New uses for pectin (ROOKER) 18. Anhydrides of aliphatic acids (HOLDE) 10. Plant composition as influenced by variations in soil type (STIEVERS, HOLTZ) 15. Sterilizing milk or fruit juices by percolation through silver-coated sand (U. S. pat. 1,642,089) 13. Apparatus for fermentation and storage of foodstuffs (U. S. pat. 1,643,018) 1.

BIDAULT, C.: *La conservation de la viande et du poisson*. Paris, 1927; J. B. Baillière et Fils. Reviewed in *Bull. soc. hyg. aliment.* 15, 273-4 (1927).

Bread. C. B. HILL and G. L. TINTNER. U. S. 1,643,011, Sept. 20. Dried yeast is added to a soln. of yeast food comprising sugar, malt ext., (NH₄)₂SO₄, Ca₃(PO₄)₂ and CaSO₄ to revivify the yeast and prep. a starter for making bread. U. S. 1,643,012 describes adding wet live yeast to a yeast nourishing medium comprising similar ingredients, allowing the mixt. to stand for yeast multiplication and using the product for making bread.

Bread. F. A. LADDEMAND. Can. 272,266, July 12, 1927. A compn. for use in the making of bread, etc., consists of 1.021 g. NaF, 1 oz. NH₄Cl, 2.5 oz. NaCl, 2.5 oz. CaSO₄, 4.252 g. (NH₄)₂HPO₄ and about 4 oz. flour. The proportions for use are 7 oz. of the compn. to 100 lbs. of flour in the dough batch.

Improving the flavor of yeast. E. B. BROWN. U. S. 1,642,537, Sept. 13. Yeast is subjected to the action of a solute such as a sugar or salt soln. under conditions as to temp. and concn. such that autolysis and fermentative activity are substantially checked, and the excess of the solute is then removed from the yeast.

Preserving and packing yeast. L. O. LEWTON. Brit. 262,063, Nov. 24, 1925. Yeast mass or cake is surrounded with a surface film such as vegetable or mineral oil or "vegetable lard" or cacao butter and then wrapped; the wrapper may be lined with the oleaginous material.

Food product from yeast. A. K. BALLS. U. S. 1,642,320, Sept. 13. Yeast is heated to a temp. of not over 150° for a period of less than 90 min. and the resulting liquid is concd.

Food preparations from pectin. H. G. LOESCH. Brit. 262,736, Dec. 10, 1925. Jellies and preserves are made by the use of a pectin prepn. contg. solid pectin suspended in a liquid medium such as ale, glycerol, or a sirup prepd. from sucrose, dextrose, invert sugar, or a mixt. of sugars, or sirups prepd. from fruit juices. Org. acids such as lactic tartaric, citric or male may be added. Numerous details are given.

Nitrogen-containing products from autodigestion of fish. M. KAHN. U. S. 1,642,209, Sept. 15. A product suitable for use as a food is obtained by maintaining fish for 1-5 days at a temp. of 37-55° in the presence of a quantity of NaCl not exceeding 10%.

Food from fish. C. BIRD-EYE. U. S. 1,642,209, Sept. 20. See original pat. 1,608,832, C. J. 21, 291.

Cocoa. H. BOLLMANN. Brit. 262,339, Nov. 9, 1925. The soly of cacao powder is increased by adding about 2% of phosphatides derived from soy beans or other suitable vegetable materials. The phosphatide used may be so purified that their phytosterol content is retained, i. e., by first adding H₂O and then distg. under reduced pressure after centrifuging to remove the main quantity of oil.

Concentrated maple flavoring. J. W. SALE and J. B. WILSON. U. S. 1,642,789, Sept. 20. Maple sirup is adjusted to a d. of about 28° B_x, heated to about 80° and is condensed after pptg. substantially all the sugar present, i. e., by adding Ba(OH)₂.

Comminuting and melting blocks of hard fats for margarine manufacture, etc. B. JIROTKA. Brit. 262,433, April 17, 1926.

Sausage casings made from disintegrated skin-splits, sinews and similar animal substances. J. SVAUCH. Brit. 262,202, Sept. 18, 1925. Brit. 262,352 also relates to sausage casings made from similar materials.

13 GENERAL INDUSTRIAL CHEMISTRY

HARRIAN MINER

Economic factors in chemical industry. J. E. TEEPLE. *Ind. Eng. Chem.* **19**, 1085-7 (1927).—A chem. industry is defined as one which produces something essentially chemically different from the raw materials, one in which the preponderance of the operations involved include chem. changes, one in which the chem. processes are under the direction and control of trained chemists, and in which the direction of the policies of the business is in the hands of men having chem. training and understanding and a chem. outlook. The growth of chem. industry thus defined has been enormous within the last 20 yrs. and touches nearly all of the materials of daily life. The future possibilities are briefly considered and the important factors in chem. industry are listed as follows: raw materials, power, markets, technically trained personnel, and "money that is needed."

A. W. KENNEY

The economic basis of industrial chemistry. WILLIAMS HAYNES. *Ind. Eng. Chem.* **19**, 1082-4 (1927).—The beginnings of chem. industry are in prehistoric times and chem. processes become more important with developing civilization. The modern chem. industry began with the industrial revolution and has developed with great rapidity. Chem. processes are now taking the place of mechanical and other manufg. processes and are especially important in the development of new materials to meet new needs.

A. W. KENNEY

Important novelties in inorganic chemical industries 1926. HERMANN VON KÉLER. *Z. anorg. Chem.* **40**, 911-24 (1924).—A review is given, contg. short abstracts of new processes in the following more industries: sulfur, sulfuric acid, sulfuric acid, sulfate and hydrochloric acid, nitrogen oxides, ammonia, cyanogen compds., hypochlorites, peroxides and peralts, various light and heavy metal industries, etc. References to 153 patents of different countries are given.

B. J. C. VAN DER HOEVEN

The relation of research to industry. W. S. JAMES. *J. Soc. Automotive Eng.* **21**, 265-7 (1927).

M. B. HART

Analysis of statistics. J. H. GRAFF. *Trans. Am. Inst. Chem. Eng.* **18**, 105-85 (1926).—A method is described for developing a quick and comparatively simple method for the analysis of statistics. The method makes it possible to find quickly the values of the correlations between any no. of factors. Factors for consideration in statistical research include (1) general economic conditions; (2) financial and operating data of the concern; (3) factors influencing the industries to which products are sold; (4) factors influencing the market conditions of the raw materials; and (5)

the kind of data tabulated and charted in the plant or research dept. Many charts and curves are given by way of illustration. W. H. BOYNTON

Chemistry and national defense. C. E. BRIGHAM. *Trans. Am. Inst. Chem. Eng.* **18**, 403-8(1926).—B. outlines the inception of poison gas warfare, the role played by chemistry, the need of chem. preparedness and the importance of defense forces against the use of toxic gases on cities under attack. "National strength is a power for peace." W. H. BOYNTON

The economical production of steam. ORDENKOVEN. *Bull. assocn. lives inst. sup. fermentations Gand* **28**, 205-10, 253-80(1927).—An address. A. P.-C.

Modern trends in steam generation. THEODORE MAYNZ. *Chem. Met. Eng.* **34**, 537-43(1927). E. H.

The production of steam from waste heat. A. J. EBNER. *Chem. Met. Eng.* **34**, 572-4(1927). E. H.

Steam metering and control. H. M. HAMMOND. *Chem. Met. Eng.* **34**, 569-71(1927). E. H.

Modern developments in the steam-piping field. A. B. WILLIAMS AND C. W. WELCH. *Chem. Met. Eng.* **34**, 547-50(1927). E. H.

Gas-fired steam boilers. A. B. GREENLEAF. *Chem. Met. Eng.* **34**, 566-8(1927). E. H.

Some odd applications of steam. CROSBY FIELD. *Chem. Met. Eng.* **34**, 577-80(1927). E. H.

Application of superheated steam in industrial processes. F. G. PAGE. *Chem. Met. Eng.* **34**, 575-6(1927). E. H.

Automatic volume control of steam and air. JOHN WOLFE. *Chem. Met. Eng.* **34**, 562-5(1927). E. H.

Application of steam accumulators. GROVER KEETH. *Chem. Met. Eng.* **34**, 571-3(1927). E. H.

By-product power from steam turbines. C. B. CAMPBELL. *Chem. Met. Eng.* **34**, 571-9(1927). E. H.

Fluid heat transmission for high temperatures in industrial processes. J. A. MAYER. *J. Soc. Chem. Ind.* **45**, 367-76T(1927). A description of the Merrill system of heating apparatus by circulating hot oil. W. L. BADGER

The flow of thick pastes through tubes. H. HERBST. *Z. angew. Chem.* **40**, 899-900(1927).—Kaolin slurries of varying water contents were forced through a meter tube of 20 mm. bore with a 5-mm. orifice at the end. A graph of pressures in atm. necessary to start the flow plotted against the water content of slurry is given. At about 30% water the curve breaks sharply, indicating enormous increase in viscosity. H. L. OLIN

Specification of losses in operation. J. P. TREUB. *Chem. Weekblad* **24**, 406-12(1927).—A method is described for calcn. of losses of each of several basic products in plant operation from monthly balance sheets by means of the least squares. B. C. J. VAN DER MOEVEN

Waste heat boiler application. J. B. CRANE. *Blast Furnace and Steel Plant* **15**, 50(1927).—In recovering waste heat, equal increments of heating surface do not recover equal amts. of heat, the later additions being much less effective. A series of calcs. should be made in such cases to det. at what percentage recovery the max. annual returns will be obtained. W. L. BADGER

Cleaning filter-press cloth. STEIN. *Tageszeit. f. Brauerei* No. 250; *Brasserie et Pâtisserie* **17**, 155-9(1927).—Results are given of a no. of treatments for removing incrustations which accumulate on filter-press cloths, the most satisfactory of which consisted in immersing 3.5 hrs. at 93-5° in 2% NaOH, letting cool overnight, rinsing lightly with cold water, brushing vigorously, rinsing in hot water and finally passing through cold 0.5% AcOH. This restores the cloth to practically its original wt. A. PAPINEAU-COUTURE

The properties and functions of filter aids. H. L. OLIN, F. V. MORRISON, J. S. PETERS AND G. H. NELSON. *Trans. Am. Inst. Chem. Eng.* **18**, 379-90(1926).—A preliminary study of a no. of substances commonly used as aids in filtration shows that they possess adsorptive capacities in varying degrees. The theory is advanced that to a large extent the clarification and flow rate increase which they bring about is due to their coagulative and adsorptive action which they bring to bear on colloids present in the slurry. Studies were made on (a) adsorptive capacities of different filter aids, (b) rate of flow tests with a large lab. filter and (c) tests on the effect of filter aids on sedimentation. H. L. OLIN

Weighing in the chemical industries. W. A. BENTON. *Chemistry & Industry*

46, 741-4, 764-7(1927).—A sketch of the industrial weighing instruments used in chem. industries is given and the relative accuracy and usefulness of each are discussed.

J. W. SHIPLEY

Researches on the theory of fine grindings. VI. The diameters of irregularly shaped crushed sand particles lifted by air currents of different speeds and different temperatures. GEOFFREY MARTIN *Trans. Ceram. Soc. (Eng.)* **26**, 21-33(1927); cf. *C. A.* **21**, 1857.—In continuation of the reported work on the fundamental laws governing the fine grinding of cements and related materials, M. finds the most accurate and rapid method of detg. the diam. of irregularly shaped particles is to estimate the velocity of the fluid which supports them. When particles are very small Stokes' law, $v = k \text{ diam}^2$, is obeyed, the const. k depending on whether the fluid flow is in stream line or turbulent flow, and also the shape and nature of the particles. As the particles become larger at some critical diam. Stokes' law gives way to the linear law, $V + \dots = k \text{ diam}$. At still higher fluid velocities the linear law is replaced by the parabolic law, $\text{velocity} = k\sqrt{\text{diam}}$. The influence of temp. on the size of particle supported by a gas stream is marked. The phenomena of evapn. and distn. in liquids are simulated by powders. A table is included giving the diam. and wt. of quartz particles lifted by air speeds from 0 to 328 ft./sec., together with mesh apertures of the chief industrial sieves. **VII. The efficiency of grinding machines and grinding media, with special reference to ball and tube mills.** GEOFFREY MARTIN, assisted by F. B. TURNER AND FRANCIS LINSTED. *Ibid.* 34-44.—The efficiency of a grinding machine is defined as the work performed by the machine in ft. lb. in increasing the surface of standard Leighton Buzzard sand by 1 sq. ft. The method of detg. the surface of sand particles consists of a rate of solu. detn. in dil. HF, as described in Parts II and III of this work (*C. A.* **20**, 2034, 2035). The relative efficiency of grinding machines can thus be detd. Their absolute efficiency can be calcd. from the heat of volatilization of brittle crystals and their mol. dimensions. The work done in grinding is proportional to the surface produced, being a statistical result similar to the law of extension of liquid films. Thus the work done in grinding to any degree of fineness desired can be calcd. from the formula $W = B(S_2 - S_1)$, where W is the work required in ft. lb., S_1 and S_2 are the original and final surfaces of the powder, and B is a const. measuring the efficiency of the machine. The most efficient grinding media in tube and ball mills are $3/4$ " steel balls followed by 1" steel balls. Flints are extremely inefficient. When the surface of the powder exceeds the surface of the grinding media by 100-500 times efficiency is obtained. Grinding in a current of air does not notably increase the efficiency. **VIII. The variation in specific gravity of quartz sands on prolonged grinding.** GEOFFREY MARTIN, assisted by WALTER WATSON AND EDGAR BOWES. *Ibid.* 45-56(1927).—After grinding quartz sand 25-50 min., the sp. gravities of 17 sands prep'd. by air elutriation are the same or slightly higher than that of unground sand, the greatest variation being 0.2%. Thus no amorphous SiO_2 was produced during the grinding. The d. of quartz is dependent on the particle size of the sample, increasing slightly with greater fineness down to 0.03 mm. diam. Prolonged grinding ($3\frac{1}{2}$ hrs.) produced a slight decrease in sp. gr. (0.004), indicating the formation of amorphous SiO_2 , calcd. to amt. to 0.92%. A vacuum pycnometer was used in these detns.

H. F. K.

Adsorption and its relation to refrigeration. F. G. KEYES. *Proc. Am. Gas Assoc.* **1926**, 729-34.—An elementary discussion of the thermodynamics of adsorption. An adsorbent to be successful in refrigeration must be cheap, high in its adsorptive capacity and must take up the refrigerant fluid with as small an integral heat of adsorption as possible relative to the ordinary heat of evapn. of the refrigerant. It must be stable chemically and physically and be non-corrosive.

H. L. OLIN

Chemistry's contribution to automotive transportation. T. A. BOYD. *Ind. Eng. Chem.* **19**, 1088-9(1927).—An introduction.

W. H. BOYNTON

Protection of enclosed spaces from noxious gas. M. E. BARKER. *Trans. Am. Inst. Chem. Eng.* **18**, 391-401(1927).—A method consisting solely of air-locks at the entrances is not satisfactory. Supply of gas-free air to the room under a slight positive pressure through suitable filters eliminates diffusion and keeps out gas.

F. D. S.

EDWARDS, JUNIUS DAVID **Aluminium Bronze Powder and Aluminium Paint.** New York: Chemical Catalog Co. 104 pp. \$3.00. Reviewed in *Mech. Eng.* **49**, 1041(1927).

REYSCHER, K.: **Die Lehre vom Trocknen in graphischer Darstellung.** 2nd ed., revised. Berlin: Julius Springer. 74 pp. R. M. 4.50.

Separation of gases. M. BENSON. Can. 273,390, Aug. 30, 1927. A mixt. of gases is sepd. by fractional soln. under pressure, the pressure of the undissolved portion of the mixt. being utilized to generate pressure on the mixt. under treatment.

Drying gases. W. MULLER. Can. 273,517, Aug. 30, 1927. Air or other gases are dried by treating with a soln. of P_2O_5 in H_3PO_4 .

Recovering volatile solvents from air or gas mixtures. I. G. FARBERINDUSTRIE AKT.-GES. Brit. 262,404, Dec. 3, 1925. Tricresylphosphates or other triarylphosphates are used for absorbing solvent vapors such as are obtained in the celluloid or artificial silk industries and in low-temp. distn. and coking.

Thickening solid and liquid mixtures. A. L. GENTER. U. S. 1,642,673, Sept. 20. Mech. features of suction, filtration, etc., are specified.

Sterilizing water, milk, fruit juices or other liquids by percolation through silver-coated sand. A. SCHREIER. U. S. 1,642,089, Sept. 13.

Insulating and dielectric material. S. BOYER. Brit. 262,473, Dec. 4, 1925. Materials such as $PhNO_2$, nitrotoluene, paraldehyde, acetophenone and TiO_2 may be used alone or together as a dielectric material or may be used to impregnate paper. Basic oxides such as those of Ca, Ba or Al may be used to reduce impurities in $PhNO_2$. Numerous modifications are described.

Protective systems for liquid-insulated electrical apparatus. M. BUCHHOLZ. U. S. 1,642,397-408, Sept. 13. Various devices are specified, for use in connection with oil transformers or similar app., in which elec.-actuated protective app. is controlled by the sp. gr., gas evolution on decompn. or other characteristics of the insulating liquid.

Photographic method of determining yielding of materials under stress. L. HARTER. Brit. 262,378, Dec. 4, 1925.

14—WATER, SEWAGE AND SANITATION

EDWARD BARTOW

Technic and practical applications of the crystallographic study of mineral waters. MAURICE PERRIN and PIERRE COLSON. *Compt. rend. soc. biol.* 97, 379-80(1927).—By the study of residues from drops of water evapd. on a slide, it is possible to distinguish a natural mineral water from an artificial imitation of that water.

L. W. RIGGS

The arsenic content of East Prussian waters. S. GOY and W. RUDOLPH. *Z. angew. Chem.* 40, 945-8(1927).—The As content of waters and of slimes does not differ greatly between industrial and non-industrial districts. The As content of the slime is several hundred times as great as that of the water. Conclusion: Bacteria remove As from the water and enrich the slime and the As content of the slime parallels its org. content.

FOSTER D. SNELL

Sulfur in rain water. S. V. EATON and J. H. EATON. *Plant Physiology* 1, 77-87(1926).—In rain water collected during 1921-23 at Chicago, Ill., there was more than 5 times as much S as that in water from a typical agricultural region (near Liberty, Ind.). Seasonal variations occur; the largest quantity of S is found in the winter rain. The quantity of S added to the soil by rain varied directly with the rainfall, but the percentage of S content of the rain water varied inversely with the pptn. The bearing of the results on soil fertility and crop yields is pointed out.

WALTER THOMAS

Additional note on water analysis. W. R. ATKIN and D. BURTON. *J. Intern. Leather Trades Chem.* 11, 204-5(1927).—The methods for hardness previously outlined (C. A. 21, 1860) are modified by the substitution of bromophenol blue for phenolphthalein in the detn. of Mg hardness.

H. B. MERRILL

Small-scale waste-water purification. O. WEICKERT. *Chem.-Ztg.* 51, 549-50(1927).—The waste liquor is clarified mechanically in a settling well, then passed through a system of drainage pipes around and finally into a self-draining seepage well. It is claimed that complete purification (partly by biol. processes) is obtained with a drain drainage tube.

B. J. C. VAN DER HOEVEN

Water softening as practiced at Oberlin, Ohio. W. H. CHAPIN. *Ind. Eng. Chem.* 19, 1182-7(1927).—C. discusses: cause and nature of hardness, manner of indicating hardness, variation in hardness, tolerance, methods of softening, reactions of the soda process, mechanism of treatment (lime-soda-alum) at Oberlin, calcn. of the soda and of soda-ash treatment, calcn. graphs, total hardness, testing the after-pptn. product and its prevention by long storage, use of alum, and the effect of sand filtration on stored water. At the Oberlin plant after-pptn. is obviated by storing the treated water for 30 days before it enters the mains. In addn. to stopping after-pptn. al-

most completely this storage has given the advantage of making filtration unnecessary.

J. A. KENNEDY

Pre-sedimentation of turbid water supplies. A. W. BULL AND G. M. DARBY. *Trans. Am. Inst. Chem. Eng.* **18**, 365-78 (1927). Pre-settling reduced the suspended solids by 85-95%. A 3 hr. pre-sedimentation reduced the coagulants required to approx. half the amts. for direct treatment. Pre-sedimentation reduces the accumulation of solids in the coagulation basin, reduces the cost of cleaning and saves the cost of chem. treatment of the water discharged with the sludge from pre-settling. When water is to be softened there is also a saving in lime. The Dorr clarifier reduces the sludge vol. approx. 30% below that obtained by direct sedimentation. Results of 7 points on the Mississippi, Missouri and Arkansas rivers were about the same. Clarifier and lab. results at Jefferson City were closely parallel.

FOSTER D. SNELL

Chlorinated drinking water and goiter and other diseases. JAMES OLIVER. *Med. Press and Circular* **175**, 49 (1927). "Since drinking water has been chlorinated, there has been such a notable decrease in endemic goiter, cancer, rheumatoid arthritis, neuritis, and other diseases that the predisposition, if not the actual cause, of some of these diseases is due to changes produced in the drinking water by chlorination."

JOSEPH S. HILPBURN

Removal of oil from boiler-feed water and water for making ice. H. JUNGWIRT. *Chem. Zp.* **14**, 391 (1927). Reuts. D'Alshoorn's method (C. I. **20**, 1482) is described.

J. H. MOORE

Protection of condenser tubes and metal surfaces in contact with water. BOURCHARD. *Art. et Matiers* No. **83**, 301-3 (Aug., 1927). Brief discussion of the merits of "apexol," a product prepared in the electric furnace at about 3300° and contg. approx. 98% of pure amorphous C. Results are given of a no. of tests which showed complete protection of condenser tubes and increase in the heat transmission coeff. These results were corroborated by application to the tubes of the boilers of the SS. Berengaria.

A. PAPINEAU-COUTURE

Sealing and corrosion of steam boilers. H. DAUSSAN. *Rev. gén. mat. plastiques* **3**, 566-70 (1927). After a brief outline of the causes of sealing and corrosion and the various methods of treatment to prevent or remedy them, D. describes a simple device consisting essentially of a chamber contg. a mixt. of specially prepd. Na_2CO_3 and Na silicate (method of prepn. and proportions not given) connected to the steam space of the boiler by means of a relatively small pipe. Steam penetrates into the chamber, condenses, dissolves the reagent, and the soln. drips back into the boiler. The merits of this treatment are discussed.

A. PAPINEAU-COUTURE

Studies on the biology of sewage disposal. New Jersey Agr. Expt. Sta., *Bull.* **427**, 103 pp. (1926). This is the fourth annual report of the sewage substation for the yr. ending June 30, 1925. **Chemical studies on Imhoff tanks.** W. RUDOLFS AND F. L. CAMPBELL. - The investigation was made in order to acquire a more exact knowledge of sludge digestion under different conditions. Analyses of gases evolved from tanks over a period of about 10 months showed that fluctuations in the CO_2 content were more or less oscillatory in character, the oscillations in general being correlated with the resting and operating periods of the tanks. Detns. of the p_H values of the liquid in the digestion chamber can be used as an index to the course of sludge digestion. Chem. and bacteriol. analyses show that the liquid between sludge and scum (from definite and const. depths) is a better indication of general activities in the tank than are the analyses of sludge filtrate. Gas production and chem. and bacteriol. analyses show that the relation between ripe sludge and incoming fresh solids is fairly definite for rapid and efficient digestion. This relation should be kept const. as nearly as practical operation will allow. **Bacteriological studies on Imhoff tanks.** MARGARET HOTCHKISS. The general bacteriol. flora are influenced by the manner of operating tanks, and seasonal effects are obscured by these short time variations. The bacteriol. numbers in a tank, which had been altered and put into operation anew, increased rapidly during the first 6 weeks, but about 5 months elapsed before the numbers were comparable to an old tank (relation between ripe sludge and fresh solids). The different groups of bacteria showed marked fluctuations, although this was not the case in a tank used for the storage of partly digested material. **Kinds, distribution and fluctuations of protozoa in Imhoff tanks.** J. B. LACKEY. - One new genus and 4 new species of protozoa have been described and figured. A recheck of previous data strengthens the conclusion that the vertical distribution of ciliates is variable, and that the max. occurrence of flagellates is near the point where the slots in the tanks occur. No seasonal fluctuation of protozoa is evident for species, genera, ciliates or flagellates. When large amts. of CO_2 are present large numbers of protozoa occur, indicating a direct relation between

- chem. end products and animal population.' Accumulation of partly digested material results in large increases in numbers of protozoa. The protozoa are independent of short ranges of p_{H} values above or below 7.0 in the tanks. Tank protozoa are largely independent of bacteria as a direct source of food: they are for the most part sapropelic; they may utilize bacterial decompn. products. The tank protozoa are either facultative or obligatory anaerobes that may be cultured in the lab. **Sprinkling filter-bed studies.** J. B. LACKEY.—The filter bed studies showed that there were surprising fluctuations in the weekly accumulation of film. There was no great difference between the numbers of animals in the old and new films. The numbers of living organisms in the film tend to maintain a physiol. level. When fungi obtain their largest vol., protozoa are fewest and *vice versa*, and when one group of animals diminishes in number another increases. **Studies on fresh solids digestion.** WILLEM RUDOLFS, MARGARET HOTCHKISS, A. J. FISCHER AND J. B. LACKEY.—Two quantities of fresh solids were placed in an incubator, one of which was kept in a tightly stoppered bottle, while to the other small quantities of air were admitted. The results show that the general course of digestion in these two bottles seemed similar, but that the type of digestion was different. In the bottle without air (A), the solid org. materials were transformed to liquid org. materials, whereas more of the org. material in the bottles with air (B) was "gassified." The production of gas was approximately 4 times larger from (B) than from (A). The rate of digestion was dissimilar with and without air. It was found that the succession of different types of decompn. was about as follows: (a) chiefly materials of a carbonaceous nature (sugars, soluble starches, etc.), (b) chiefly nitrogenous materials (proteins) and (c) chiefly complex carbohydrates (cellulose, fibrous matters and carbonaceous material of partly decompd. proteins). These "cycles" are repeated until all material is "mineralized" and "gassified." **The relation between ripe sludge and fresh solids and the effect of "washing" on digestion.** WILLEM RUDOLFS, H. HEUKELKIAN, P. J. A. ZELLER AND J. B. LACKEY.—There must be maintained a definite relation between sludge and incoming fresh solids. Under favorable conditions ripe sludge cannot handle more than 2% fresh solids daily (computed on dry basis). There is a definite relation between nos. of protozoa and certain bacterial decompn. products. Addn. of tap water (washing) to the sludge-fresh-solids-mixt. produced a better looking sludge. **Notes on the more unusual Imhoff tank gases.** F. I. CAMPBELL AND WILLEM RUDOLFS.—See C. A. 20, 252 **Effect of stirring on digestion.** WILLEM RUDOLFS.—All samples after standing 1 day smelled faintly putrefactive and looked alike, had a blackish color, with all solids at the top. The p_{H} decreased, the material having a strongly putrefactive odor, until after about 3 weeks when the p_{H} values rose. Results indicate that no advantage was gained by too frequent stirring. It is possible that the effect of air overcomes the possible beneficial effects of stirring, and expts. are under way to det. the possible effect of stirring under positive anaerobic conditions. **Preliminary results on chemical precipitation as an aid to digestion in Imhoff tanks.** A. J. FISCHER.—The addn. of an alkali or an alk. salt will cause the solids to settle to the bottom of a tank, causing digestion to proceed more rapidly. Neutral Ca salts such as CaCl_2 will serve the same purpose. Lime should prove beneficial provided not too much is added. It appears that CuSO_4 , although of no value for settling solids, might be used to dry greasy scum. **Preliminary notes on partial sterilization.** WILLEM RUDOLFS AND H. HEUKELKIAN.— CuSO_4 and HgCl_2 in concns. varying from 1:100,000 to 1:1,000,000 depress the numbers of protozoa and stimulate the numbers of bacteria. Toluidine in 1:1000 killed off all protozoa, and in 1:10,000 greatly suppressed their numbers. Lime in concns. of 1:750 and 1:1000 killed all protozoa within 24 hrs.; when fresh solids were added, making the mixture less alk., the protozoa were markedly stimulated. CS_2 emulsion in concns. varying from 1:1000 to 1:5000 killed off all protozoa and suppressed their growth for over a month; even in lower concns. such as 1:500 and 1:10,000 their nos. were greatly reduced. However, in a concn. of 1:15,000 there was a marked stimulation of the nos. of protozoa after 1 week. E. F. S. **Sewage of the city of Buenos Aires. Its discharge into the Rio de la Plata.** A. BADO AND V. J. BERNAOLA. *Anales asoc. quim. Argentina*. 25, 105-37(1927). E. M. SYMMES **Procedure for clarifying large amounts of liquids (city or industry waste liquids) by means of dam or crater filtration.** E. R. BESEMFELDER. *Chem.-Ztg.* 51, 505-6 (1927). -Descriptive. A. L. HENNE **Active substance of the Baresges waters (ROBINE, DEJUSSIEU) 11A. The removal of phenol from coke-works waste water (RACHIG) 21. Sterilizing water by percolation through silver-coated sand (U. S. pat. 1,642,089) 13.**

Softening hard water. G. PETROFF and P. SHESTAKOFF. U. S. 1,642,594, Sept. 13. H_2O to be softened is treated with sulfonic acids of high mol. wt., *e. g.*, with naphthol-sulfonic acids.

Hardening and sealing water-bearing strata in the ground. T. BLANDFORD, A. GEE and H. E. POTTS. Brit. 262,223, Oct. 14, 1925. A soln. of caustic alkali or alkali carbonate is injected into the ground, with or without an org. substance such as soap, followed by a cement suspension.

Apparatus for testing water while undergoing softening or for testing other liquids. H. S. HATFIELD. U. S. 1,643,213, Sept. 20. A relay device and indicator are arranged to be actuated by frothing or other changes such as are produced by the addn. of soap soln. to hard H_2O .

Precipitated zeolites. H. KRIEGSHIEIM and W. VAUGHAN. U. S. 1,642,880, Sept. 20. In the manuf. of pptd. zeolites having a large area of quick-acting surface, a gel body of normal structure is produced by the action of a soln. of Na aluminate on a soln. of Na silicate; this body is partly dried in its original condition, without sepn. of H_2O prior to drying, and this is followed by washing and further drying.

Base-exchange composition. A. S. BEHRMAN. Can. 271,393, June 7, 1927. A metallo-silicate is produced by mixing a soln. of an alkali metal silicate, an acid and a non-alk. soln. of an amphoteric hydroxide to form a stiff firm gel, which is dried by heating, and the heated mass is then wetted to remove the sol. compds.

Lining for water pipes. O. G. LUYWIES. U. S. 1,643,021, Sept. 20. Linings are formed of cork, fibrous material such as asbestos and a binder, *e. g.*, an asphaltic mixt. contg. linseed oil and gilsonite.

Water-wheel for use in automatic sewage-distributing apparatus. J. W. HARTLEY. Brit. 262,680, May 29, 1926.

Apparatus for sewage treatment by activated sludge and sludge digestion methods. K. IMHOFF. U. S. 1,642,206, Sept. 13.

Rotary sewage distributor for filter and bacteria beds. J. W. HARTLEY. Brit. 261,852, Aug. 29, 1925.

Incinerator for garbage, etc. W. C. EPSTEIN. U. S. 1,643,206, Sept. 20.

Apparatus for fumigating with hydrocyanic acid. K. A. KILBOURNE. U. S. 1,642,779, Sept. 20. Liquid HCN is used.

Apparatus for generating hydrocyanic acid for fumigating. H. LAINE. Brit. 262,423, Dec. 5, 1925.

Spraying apparatus for fumigating with liquid hydrocyanic acid. K. F. COOPER. U. S. 1,642,920, Sept. 20.

15—SOILS, FERTILIZERS AND AGRICULTURAL POISONS

J. J. SKINNER

Grouping of soils on the basis of mechanical analysis. R. O. E. DAVIS and H. H. BENNETT. U. S. Dept. Agr., *Circ.* 419, 1 14(1927).—The proportions of sand, silt and clay of a sample of soil cannot be shown on a right-angled diagram. The mech. compn. of the main soil classes may be graphically indicated on an equilateral triangle by showing their percentage compn. of sand, silt and clay. The proposed diagram is an improvement over the earlier ones of the Bureau of Soils in that it includes the proportion of sand as well as of silt and clay, it being necessary on the earlier diagrams to det. the third component from the other two. Twenty principal and subordinate soil classes based on mech. compn. are recognized. These may be grouped into 3 major classes according to their clay content. W. H. ROSS

Is the soil reaction of any importance in practical agriculture? M. TRENEU. *Z. Pflanzenernahr. Düngung, Abt. B* 5, 169-81; *Chem. Zentr.* 1926, I, 3098; cf. *C. A.* 21, 2346.—In work closely related to practical agriculture, it is shown that the soil reaction charts, which are obtained with the "acidimeter" of T., reflect the tendency to grow of "acid sensitive" cultivated plants, including sugar beets, barley, clover, alfalfa, peas and beans. As soon as the $[H^+]$ in suspensions of soil contg. KCl was more acid than $pH = 6$, these plants were injured and the yield was diminished. Oats and wheat gave max. yields at a pH of 5.2, and at pH 4.3 the oats were injured. Judged by yield, potatoes are insensitive to an acid medium with a pH value of 4.2. Rye is indifferent to variations in the acidity of the medium between pH 4.2 and 7.6. Investigation of the subsoil is of great importance, otherwise false conclusions are inevitable.

C. C. DAVIS

A fundamental study of the mechanism of buffer action in soils. P. B. MYERS AND G. L. BAKER. Delaware Agr. Expt. Sta., *Bull.* 141, 13-4(1925).—Several soil types were ignited and 3 samples of each titrated with acid and alkali. In all cases the initial p_H increased with temp., probably because of the destruction of an org. acid, or the conversion of the metals to the oxides or carbonates. The buffer action decreases with increased temp. The titration curves show that the buffering power of the Norfolk Sand is nearly destroyed at the medium temp. (about 450°) while the curves of the other types of soil show that the change in buffering power due to heating is more gradual than with the sand. It is proposed to study the effects of added colloidal matter on highly ignited soils. E. F. SNYDER

Soil studies at the Washington Station. The maintenance of organic matter in eastern Washington soils. F. J. SIEVERS AND H. P. HOLTZ. Wash. Agr. Expt. Sta., *Bull.* 196, 38-41(1925); 35th ann. rept. for the yr. ending June 30, 1925.—In any system of practical agriculture it is impossible to maintain the soil org. matter constant at the point at which it was found in the virgin state. The only exception to this rule is under conditions where arid soils are brought under irrigation and are then formed under what virtually amounts to changed climatic conditions, thus making more luxuriant plant growth possible. Crop residues like straw which are low in N have a depressing effect on NO_3 accumulation and on yield when first applied to a soil. Distribution of org. matter in the soil is influenced in a very pronounced degree by soil reaction. **Fertility investigations of Washington soils.** *Ibid.* Sufficient data are available from all sections of the state to make it possible to distribute information regarding the plant food deficiencies of the various soil types. **The fixation and distribution of nitrogen and organic matter by legumes in Palouse silt loams.** A. FLOYD HICK. *Ibid.* The object of this investigation is to establish the amts. of atm. N fixed by various legumes when grown in Palouse silt loam and also the amt. and distribution of their org. matter. **Plant composition as influenced by variations in soil type.** F. J. SIEVERS AND H. P. HOLTZ. *Ibid.* This investigation was undertaken because of the interest of Western Wash. dairy farmers in obtaining relief from what appeared to be nutritional disorders in their stock. It would seem that nutritional disorders, if they exist, as they apparently do, might be assoc. with low P and Ca content of the feed and that they might in the main be overcome indirectly through systems of soil management that will make it possible or less difficult to produce legume hays. E. F. SNYDER

The nature of organic soil constituents; the role of microorganisms in their formation and decomposition. S. A. WAKSMAN. *Naturwissenschaften* 15, 689-96(1927).—A review of recent work (cf. C. A. 21, 1512). A bibliography is added.

B. J. C. VAN DER HOEVEN

The soluble silicate content of soils. W. R. G. ATKINS. *Sci. Proc. Roy. Dublin Soc.* 18, 433-6(1927).—It is suggested that a detn. of the silicate in soln. may afford a rapid method of detecting a soil of low fertility, as well as a detn. of the cond., but the former is made in less time and with less costly app. The sol. silicate was estd. by the method of Diénert and Wandenbuleke (C. A. 18, 1540, 2096), or alternatively, by the method of Diénert (C. A. 16, 3831). Since silicates are taken up by the plant its presence in soln. and varying quantities in the soil may be a factor of significance. I. W. RIGGS

Disintegration of incrustated cellulose in the soil. •II. Stubble and roots of grain-producing plants in sandy soil. CHR. BARTHEL AND N. BENGTSOHN. *Kgl. Landbruks-Högh. Handl. Tid.* 66, 306-15(1927); cf. C. A. 20, 1881.—The content of the more or less sol. N combinations in grain-producing and leguminous plants is sufficiently high to furnish the N necessary for the decompn. (fermentation) of incrustated cellulose, which may explain the relatively rapid disappearance of stubble and roots in the soil. The rate of disintegration of cellulose is directly proportional to the N content of the plant material within the same group of plants such as the straw-producing or the leguminous plants located in sandy soil deficient in N. When different groups are compared with one another the relationship of the rate of cellulose decompn. to the N content varies much. The decompn. is much slower in the leguminous plants than in the straw yielding group, even though the N content of the former is many times that of the latter. The reason for this may be ascribed to the higher % of non-cellulosic N compounds present in leguminous plants, these compds requiring more of the N of the plant material for their decompn. E. O. ELLINGSON

Changes of bases in arable soils. P. BOISCHOT. *Rev. sci.* 65, 302-6(1927).—A review. A. PAPINEAU-COUTURE

Determination in the cold of ammonia nitrogen in soils and fertilizers. A. DEMOLINS. *Ann. fals.* 20, 412-3(1927).—The detn. is carried out by placing the sample,

together with a suitable amt. of H_2O and concd. $NaOH$, in a flask and drawing a rapid current of air successively through H_2SO_4 , the sample, standard acid, and distd. H_2O (to stop any acid that might be entrained), a suitable trap or valve being interposed to prevent possible backing of the water from the siphon pump. With 1 g. of fertilizer contg. 6% NH_3 N, the detn. can be stopped after 2.5 hrs. For soils, use a 25-g. sample, 50 cc. H_2O and 2 g. Na_2CO_3 .
A. PAPINEAU-COUTURE

Soil acidity in relation to spinach production. H. H. ZIMMERLEY. Va. Truck Expt. Sta., *Bull.* 57, 501-21 (1926).—Expts. were conducted for the purpose of detg. the soil reaction range for optimum growth of spinach, the greatest degree of soil acidity at which spinach may be produced profitably and the effects of various amts. of lime in reducing the H -ion concn. of the more important types of soil used locally for spinach production. The reaction range for optimum growth occurred between pH 6.5 and 7.0 except in 1924 when the highest yields were secured on the slightly alk. soils. A soil reaction of pH 5.5 was found to be the lower limit for profitable production under optimum conditions of temp., moisture and fertility. On soils more acid than pH 5.0 injury was usually severe. The effectiveness of lime in reducing acidity varied with the types of soil. Large applications of lime may be wasteful and dangerous. The economical procedure, even where a neutral reaction is desirable, is the application of only sufficient lime to bring the upper 4 in. to the desired reaction a short time before planting.

E. F. SNYDER

The relation of the soil nitrogen to nodule development and fixation of nitrogen by certain legumes. GUNNAR GLOBEL. New Jersey Agr. Expt. Sta., *Bull.* 436, 3-125 (1926).—Pot culture expts. with alfalfa have demonstrated conclusively that infection and the establishment of the process of N fixation proceed best in plants well supplied with combined N during the early stages of growth. Under the exptl. conditions alfalfa fixed very little N during the first crop before the flowering stage. After this stage fixation took place very readily in one expt., and in all cases N was fixed to the full capacity during the second and the following crops. The amts. of N fixed, in all cases, were inversely proportional to the amts. of sol. soil N at the disposal of the plants. On soils depleted of N , gains in soil N resulted from the growth of 6 crops of inoculated alfalfa when the tops were removed. On the other hand, on soils well provided with N in available form, losses in soil N occurred. Pot culture expts. with soy beans indicated that small amts. of combined N are desirable for the early growth of the plants and for best nodule development. With soy beans, however, this was much less pronounced than with alfalfa. The removal of tops of inoculated soy beans resulted in a slight gain in soil N on one soil of medium fertility. On soils richer in NO_3 , losses occurred and these were larger with the larger amts. of NO_3 in the soil. With soy beans grown in soil, approx. 8% of the total N in the plants was found in the roots. Nodule development by alfalfa and soy beans was adversely affected by the presence of larger amts. of NO_3 in soil or sand cultures. The depressing effect of NO_3 on nodule development and the process of N fixation appeared to be connected with the nutrition of the plants, the NO_3 being used in the first place to fill the need of N by the plant. An extensive bibliography is given.

E. F. SNYDER

The evolution of the fertilizer industry. JAMES HENDRICK. *Trans. Highland and Agr. Soc. Scotland* [5], 39, 79-96 (1927).—A general discussion with particular reference to recent developments in the manuf. of fertilizer materials.

K. D. J.

Mucks, peats and miscellaneous fertilizer materials. F. T. SHUTT. Dept. Agr. Canada, *Rept. Dominion Chemist, Year Ending March 31, 1926, 1927*, 32-46.—Partial analyses are tabulated for 42 samples of muck and peat from deposits in various parts of Canada. Complete analyses are given for samples of *flue ashes from cement kilns*, "lime sludge" from pulpwood plant and eelgrass ash. Partial analyses are given for samples of *lime-kiln waste*, *marine mud* from a deposit near Halifax, N. S., *seaweed (Fucus serratus)* from Pictou, N. S., and other miscellaneous fertilizer materials.

K. D. J.

Annual report of the economic botanist to the government of Bengal for the year 1925-26. G. P. HECTOR. *Ann. Rept. Dept. Agr. Bengal, Year 1925-26, 1927*, pp. 1-8.—The *transpiration ratio of rice plants* grown in soil at 75% satn. was reduced from 515.6 to 480.5 by applications of phosphate fertilizer. In soils at 33% satn. the ratio was reduced from 542.7 to 438.1.

K. D. JACOB

Annual report of the agricultural chemist to the government of Bengal, Dacca, for the year ending March 31, 1926. M. CARBERY. *Ann. Rept. Dept. Agr. Bengal, Year 1925-26, 1927*, pp. 9-39.—Data are given on the *compn. of the ash of sugarcane juice* produced from 7 varieties of cane. The % of all the inorg. constituents of the juice was reduced by cutting off the cane flowers. Numerous analyses of the *ash from healthy and diseased betel vines* did not indicate that the disease was due to any

excess of deficiency of inorg. compds. In expts. on a red laterite soil it was definitely established that large single applications of lime reduced the availability of the soil K_2O , but frequent small application did not have any appreciable harmful effect. Phosphate and nitrate were essential to the growth of rice in water cultures. Lack of Mg had no effect and lack of K_2O very little effect. K. D. JACOB

Effect of potash fertilizer on the carrying quality of tomatoes. W. B. LANHAM. Texas Agr. Expt. Sta., *Bull.* 357, 38 pp. (1927).—Expts. are reported showing the effect of K on the yield and carrying quality of tomatoes. In the spring of 1926 a series of expts. was started with 5 varieties at 4 different Substations to find out the effect of K on the yield and the carrying quality of tomatoes. Four fertilizer formulas were used. The fertilizer used in the check plats contained 8% P_2O_5 , 4% NH_3 and no K_2O . The other plats received the same amts. of P_2O_5 and NH_3 and in addn. 4, 6, and 8% K_2O , resp. The tomatoes were subjected to various tests to study their resistance to rough handling. Some green tomatoes were shaken until they broke, some were dropped from a given height until they cracked, others were crushed until they broke, and still others were kept in storage until they ripened. Some of the ripe tomatoes were shaken until they broke and some were kept in storage until they decayed. K in the fertilizer increased the yield, but had no consistent effect on the carrying quality, as measured by the above tests. The time of harvest and the differences between varieties were much greater than the difference between tomatoes grown on plats contg. various amts. of K. J. J. SKINNER

The effect of fertilizing a crop on the vegetative and reproductive capacity of the seed. B. V. NATH, M. SURYANARAYANA AND R. MCCARRISON. *Memoirs Dept. Agr. India* 9, 85-124 (1927).—In plot and pot expts. with wheat, *ragi* and *pani varagu*, seed from plants fertilized with mineral fertilizers, cattle manure or no fertilizer were sown in an unfertilized soil of moderate fertility and the yields from the second crop were compared. In practically all cases the effect of fertilizing the crop persisted in the seed and was visible in the next crop. Crops fertilized with cattle manure gave seed with better cropping value than seed from crops fertilized with mineral fertilizers and the latter gave seed with better cropping value than seed from unfertilized crops. However, the superiority of seed from crops fertilized with mineral fertilizers varied with the nature of the crop. The results of animal nutrition expts. with the same grains as those used in the plant expts. showed that the "cattle manure seed" were more nutritious than "mineral fertilizer seed" or "no fertilizer seed." Synthetic farmyard manure, prepd. by fermenting grass and stubble, had as high a fertilizer value as fermented natural farmyard manure and both were superior to unfertilized manure. The H_2O and alc. exts. of fermented manure and the residue from the extn. had practically the same fertilizer value. The H_2O ext. of fresh manure was superior in its fertilizer value to that of the residue but was distinctly inferior to the H_2O ext. of fermented manure. Small amts. of yeast had a stimulating effect on the crops and gave nearly 1.5 times the yield obtained with fermented farmyard manure. It was shown that this effect was not due to the N and P_2O_5 content of the yeast. The results of the expt. indicated that org. fertilizers, besides improving the phys. condition of the soil and being sources of ordinary food for plants, also supply some agents like auximones or vitamins which contribute greatly to the growth and reproduction of plants and through the plants and their seed supply additional food to animals and plants. K. D. JACOB

Liquid phosphoric acid as a source of phosphorus for plants. D. DRUZHININ. *J. chem. Ind. (Russia)* 2, 382-5; *Chem. Zentr.* 1926, I, 3352-3.—On sandy podsol soil, which contains only 0.03% adsorbed Ca, the yield of oats is considerably lowered by 25 g. of liquid H_3PO_4 per plant, is increased about 50% by 6 g. of $CaCO_3$ and is increased still more by $H_3PO_4 + CaCO_3$. On loamy podsol soil, with 0.08% adsorbed Ca , H_3PO_4 also exerts a favorable action, while $CaCO_3$ has an unfavorable one. About 3 fold yield is obtained by fertilizing with $NaNO_3$ and H_3PO_4 , while $NaNO_3$ alone is ineffective. The injurious action of H_3PO_4 on soils poor in lime is explained by the acidification of the soil by the H_3PO_4 and the consequent arrest of nitrate formation by bacteria. Mixed with $NaNO_3$, H_3PO_4 is still more energetic than the corresponding quantity of superphosphate. C. C. DAVIS

Experiments with fertilizing eucalyptus trees. JAMES WATSON. *Rhodesia Agr.* 24, 767-9 (1927).—It is generally believed that tap-rooted trees do not make much response to the application of fertilizers. However, after 16 months the av. height of unfertilized eucalyptus trees was 6 ft. and of 70 unfertilized controls 2.2 ft. A. L. MEHRING

The results of experiments on the experimental field of Dolgoprudnoje in the year

1923-24. N. G. KOSHECHKIN. *Trans. Inst. Fertilisers Lief* 30, 47-63(1925); *Chem. Zentr.* 1926, I, 2040-1.—Moscow phosphorite, with 24% P_2O_5 , increases the yield of rye at least 30% when 80-1000 kg. of P_2O_5 per hectare are used, and $CaCO_3$ increases it by 36% for 9000 kg. per hectare. $CaCO_3$ also increases the yield of clover when 2250-22,500 kg. per hectare are used and changes the proportion of weeds to Graminaceae in favor of the Graminaceae. C. C. DAVIS

Inoculation of alfalfa on lime-deficient sandy soils. Soil transfer vs. use of cultures. F. J. ALWAY AND G. H. NESOM. *Minnesota Agr. Expt. Sta., Tech. Bull.* 46, 62 pp.(1927).—(Observations and expts. are reported on the growth of alfalfa on widely scattered sandy fields in Minnesota, all more or less lime deficient toward both alfalfa and sweet clover, and on which the H-ion concn. of the surface soils was between 5.0 and 6.0. On one of the fields the crop had been under observation for 8 consecutive seasons and on the others for shorter periods. When the land had been limed well in advance of the seeding, the use of artificial cultures was as effective as a heavy application of soil from an established field of alfalfa or sweet clover; but when it had not been limed, the soil transfer method was far more effective with the first seeding. Increasing the amt. of culture to many times the usual rate did not make it as effective as soil transfer. The difference between the 2 methods appears to increase with the lime deficiency of the land being seeded. The growing of alfalfa or sweet clover on such unlimed soils, even where the stand was thin and only a few of the plants were vigorous, satisfactorily inoculated a following seeding of alfalfa. On these soils, when inoculation has been effected by soil transfer or by the previous growth of alfalfa or sweet clover, remunerative crops of alfalfa may be grown without lime. On all except the least lime-deficient fields, however, liming increases the yields even where satisfactorily inoculated by one of the above methods, but the increase actually due to liming, independent of its influence on inoculation, may be too small to be profitable, and during a drouth the beneficial effect may be entirely masked. Liming expts., in which the current pure culture methods of inoculation are relied upon, are likely to lead to very erroneous conclusions as to the economy of liming such soils for alfalfa. J. J. SKINNER

Testing corn stalks chemically to aid in determining their plant food needs. G. N. HOFFER. *Indiana Agr. Expt. Sta., Bull.* 298, 31 pp.(1926).—A method is given for recognizing deficiencies in soils of the nutrient necessary for the proper growth of corn plants. The method is based on the color reaction of the cut surface of mature corn stalks to solns. of diphenylamine, KCNS and HCl. N and K deficiencies in the soil are indicated. J. J. SKINNER

Granulated cyanamide and dicyanodiamide. G. LEFORT DES YLOUSES. *Chimie et industrie* 18, 216(1927); cf. Dutoit, *C. A.* 18, 1874-5; Brioux, *C. A.* 21, 790.—Y. attributes the unfavorable results obtained by B. with dicyanodiamide to the fact that his expts were carried out in pots, with an excessive dose (approx. 20 mg. per kg. of soil), and with white mustard and buckwheat which are particularly sensitive to the action of dicyanodiamide. Field expts. and experience with dicyanodiamide (as present in "Eusac" brand granular cyanamide) in agricultural operations have given much more favorable results, and considerable increases in crops have been obtained even with products contg. up to 80% of their N in the form of dicyanodiamide. Highly compressed cyanamide contg. considerable proportions of dicyanodiamide are much less dangerous than similar products in powd. form and can be used as top dressing. A. PAPINEAU-COUTURE

Evidence on the indispensable nature of zinc and boron for higher green plants. A. L. SOMMER AND C. B. LIPMAN. *Plant Physiology* 1, 231-49(1926).—The expts. were carried out in nutrient solns., using purified salts, in a small greenhouse equipped so as to furnish a dust-free atm. Sunflowers, cotton, barley, buckwheat, castor beans, flax and mustard made little growth in a culture soln. composed of KNO_3 (800 p.p.m.); KH_2PO_4 (150 p.p.m.); $MgSO_4 \cdot 7H_2O$ (500 p.p.m.); Mn as $MnSO_4$ (1.5 p.p.m.); Al as $Al_2(SO_4)_3$ (0.5 p.p.m.); NaCl (12.7 p.p.m.); $CaSO_4$ (300 cc. satd. soln.); Zn (0.5 p.p.m.); and $FeSO_4$ (trace). Good growth, however, was obtained in the above medium when 0.5 p.p.m. of H_3BO_3 was added. Also barley and sunflowers made little growth in the above culture medium when the Zn was replaced by B. The addn. of 0.5 p.p.m. Zn, however, resulted in good growth. WALTER THOMAS

The current mineral nutrient content of the plant solution as a possible means of chemical control of optimum fertilization. B. E. GILBERT AND L. J. HARDIN. *J. Agr. Research* 35, 185-92(1927).—The current concns. of mineral nutrients in the solns. of crop plants in general correlated directly with applications of chem. fertilizers. K showed the least fluctuation during the season, nitrate N the most, while the fluctuation of phosphate P was intermediate. The current mineral nutrient content of the plant

soln. is suggested as an index of fertilizer needs and tentative crit. concns. have been chosen for each nutrient. W. H. ROSS

A note on *Danthonia*, with particular reference to the effect of sulfuric acid on the germination of the seed. H. C. TRUMBLE. *J. Dept. of Agr. So. Australia* 30, 1210-13 (1927).—Immersion of *Danthonia pilosa* seed in H_2SO_4 (d. 1.84) causes the greater part of the glumes to be removed and stimulates germination. Expts. indicate that 5 min. is optimum time for immersion. The seeds must then be rapidly washed for 5 min. to remove free acid. Fifteen min. immersion in the acid destroys about 50% of the seeds, and no seeds survive the treatment longer than 30 min. Seed treated with the acid for 5 min. and subsequently washed and dried retain the capacity for germination the same as untreated seed. M. S. ANDERSON

Assimilation of fixed nitrogen by Havana tobacco. A. B. BEAUMONT AND G. J. LARSINOS. *Science* 66, 237(1927).—Havana tobacco is capable of assimilating urea N in the unchanged form. Plant growth, however, is not as rapid with urea as a source of N as with $Ca(NO_3)_2$ or $NaNO_3$. M. S. ANDERSON

Two experiments on tobacco. J. CARBONEL. *Rev. agr. Maurice* 4, 48-50(1927).—Two series of fertilizer tests in the Gironde, France, have shown that heavy applications of $NaNO_3$, up to 400 kg. per hectare, pay best; that the nitrate should be applied in 2 doses, at planting and at the 2nd hoeing; that nitrate is superior to cyanamide. F. W. ZERBAN

Physiological and chemical aspects of cereal straw. ANON. New York Agr. Exp. Sta., *Rept.* 1926, 17 pp.—A mixt. of $(NH_4)_2SO_4$, acid phosphate, KCl and ground limestone rotted straw in 3 to 5 months, when kept wet. The process required packing and was considered impractical for large-scale operations. J. J. SKINNER

Soil bacteriology work at the Delaware station. T. F. MANNS. Delaware Agr. Expt. Sta., *Bull.* 147, 35-7(1926).—Most sulfates stimulate S oxidation. K_2SO_4 is most active; the sulfates of Fe, Al and Mg show slight stimulation. S oxidation is rapid in soil or org. composts. Plant tests were used to study the availability of P made citrate-sol. by the S-oxidation process, which was compared with P in com. fertilizers. J. J. SKINNER

Comparative biological and chemical studies of stable manures. G. RUSCHMANN. *Centr. Bakt. Parasitenk.* 2 Abt. 70, 214-60, 383-411(1927). JOHN T. MYERS

Phyto-pharmacotherapy. D. VAN OS. *Pharm. Weekblad* 64, 861-9(1927).—A discussion of the enormous losses caused in various countries by the depredations of animal pests, insects and plant diseases, and the means of combating them, e. g., by rotation of crops, development of disease-resistant varieties and the use of insecticides and fungicides. A. W. DOX

Development of more effective dust fungicides by adding oxidizing agents to sulfur. H. A. LEE AND J. P. MARTIN. *Science* 66, 178(1927).—The fungus disease of sugarcane, called eye spot, is but little affected by ordinary fungicidal dusts and sprays. The action of S dust alone produces only slight reduction of the disease, but when an oxidizing agent is present the efficacy of the S is greatly increased. Cane treated with S to which 1.0% pulverized $KMnO_4$ had been added showed a reduction of 89.9% of infections compared with undusted plots. S plus 0.25% HNO_3 reduced the disease 61%. $KMnO_4$ in a non-S carrier such as kaolin was ineffective. The treatment with oxidized S preps. appeared to stimulate growth independent of the disease control. M. S. ANDERSON

Relation of size of oil drops to toxicity of petroleum-oil emulsions to aphids. E. I. GRIFFIN, C. H. RICHARDSON AND R. C. BURDETTE. *J. Agr. Research* 34, 727-38 (1927).—Petroleum-oil emulsions were prepd. (1) while hot under pressure, (2) by a colloid stir method, and (3) by grinding in a colloid mill, to give a series of preps., with and without emulsifiers, in some of which the oil droplets were large and in others small. The emulsions in which the oil droplets were relatively large were decidedly more toxic to *Uribis rumicis* than those in which the droplets were small. The toxicity of the preps. as correlated with drop size was not influenced by the phys. characteristics of the oil, the presence or absence of a soap emulsifier, or the presence or absence of cresol. When plants are sprayed with emulsions of large drop size more oil is retained by the plant surface than when sprayed with emulsions of small drop size. It is suggested that the elec. charges of plant surfaces and oil droplets are a factor in detg. the ability of oil in an emulsion to adhere to plant surfaces. Under conditions of comparable drop size and type of oil, miscible oils are probably less toxic to insects than the ordinary petroleum oils because they contain smaller oil droplets and the oil therefore adheres to the plant less effectively. W. H. ROSS

The codling moth. I. S. L. ALLMAN. *Agr. Gas. N. S. Wales* 38, 551-6(1927).—

Pb arsenate solns. of varying concns. were compared with Ca arsenate and Na arsenite in expts. on the control of codling moth apple. In regard to the % of infested fruit, % calyx infestation, and the ratio of stored to larvae, the best results were obtained with Pb arsenate used at the rate of 36 ounces per 50 gallons of H₂O. Na arsenite at concns. as low as 0.02 ounce per gallon caused severe foliage burns. Combined sprays of lime-S and normal Pb arsenate gave pronounced spray residue which necessitated washing the fruit. K. D. JACOB

Prevention of weevil infestation by use of copper carbonate. H. C. STENING. *Agr. Gaz. N. S. Wales* 38, 589(1927). Wheat treated with Cu carbonate dust at the rate of 2 ounces per bushel was not attacked during 12 months storage under conditions favorable to weevil infestation. Untreated wheat stored under the same conditions was severely attacked. Germination of the wheat was not affected by treatment with CuCO₃. K. D. JACOB

Sulfur in rain water (EATON, EATON) 14. The adaptation of certain colorimetric methods to the estimation of nitrites, phosphates and potassium in plant solutions (GILBERT) 11D. Oxygen supplying power of the soil (HUTCHINS) 11D. Phosphate rock (JACOB) 18. Tobacco cultivation and fertilization (DE SORNAY) 17. Geology of the country around Ipswich, England [deposits for use in agriculture] (BOSWELL) 8. Fertilizer deposits of S. Africa (FILLING) 8. Fertilizer from sulfite liquor (Can. pat. 271,893) 23. Apparatus for fermentation and storage of fertilizer (U. S. pat. 1,643,018) 1.

BEAR, FIRMAN E. **Soil Management.** 2nd ed., revised and enlarged. New York City: John Wiley & Sons, Inc. 412 pp. \$3.50.

Fertilizer. B. BODRERO. Brit. 262,017, July 26, 1926. In the prepn. of a phosphate fertilizer contg. S, vapor of S is led into a mixing-vessel lined with Pb and deposited as a sublimite on finely powd. Ca phosphate.

Vermine-destroying composition. W. HEERDT. Can. 271,863, June 28, 1927. A compn. for destroying plant and animal pests comprises HCN and kieselsuhr.

Fungicide. J. D. JENKINS and E. F. BERGER. U. S. 1,642,370, Sept. 13. A colloidal dispersion of Cu₂O and metallic Cu is formed from compds. such as Cu hydride or basic Cu sulfate, NaOH and corn sirup and is used with a protective colloid such as gum arabic.

Insecticide and fungicide. G. E. SANDERS. U. S. 1,642,511, Sept. 13. A material suitable for use as a dusting powder is formed by mixing As₂O₃, lime and sufficient H₂O to hydrate the lime and form a paste, adding a fungicidal salt such as CuSO₄ and then adding a further quantity of lime sufficient to take up all free H₂O. Cf. C. A. 21, 1526

16 - THE FERMENTATION INDUSTRIES

C. N. FREY

Synthetic methanol and ammonia from butyl fermentation gases. J. C. WOOD RUFF. *Ind. Eng. Chem.* 19, 1147-50(1927).—The Comm. Solvents Corp'n. plants at Terre Haute, Ind., and Peoria, Ill., for the manuf. of butanol from corn produce together about 6 million cu. ft. daily of by-product gas approx. 60% of which is CO₂ and 40% H₂. The vapors of EtOH, C₄H₉OH and (CH₃)₂CO present in the waste gases are removed by activated coconut charcoal, then the major portion of the CO₂ by pressure scrubbers and the last traces in a NaOH tower. The purified H₂ is then mixed with N₂ and NH₃ produced by passing the gas at 300 atm. pressure over a suitable catalyst at the optimum temp. The particulars are not disclosed. At Peoria the NH₃ process has recently been abandoned, and the waste gases are converted into MeOH with the aid of "highly efficient and novel catalysts. . . . protected by recently issued patents." CO₂ + 3H₂ → CH₃OH + H₂O. A portion of the CO₂ (about 75%) is first removed in pressure scrubbers. If the CO₂ be converted into CO first, the loss of H₂ as water is eliminated (CO + 2H₂ → CH₃OH). E. G. R. ARDAGH

Production of lactic acid by fermentation of wood sugar remaining after alcoholic fermentation. E. A. MARTEN, E. C. SHERRARD, W. H. PETERSON and E. B. FRED. *Ind. Eng. Chem.* 19, 1162-5(1927).—Lab. expts. show that the waste residue from the alc. fermentation of wood-sugar liquor can be fermented. The ratio of AcOH to lactic

acid produced is dependent upon the kind of sugars present in the liquor. This varies with the wood used and the extent of the previous alc. fermentation. Soft wood liquors give a larger proportion of lactic to acetic than do hardwood liquors.

E. G. R. ARDAGH

Improved method for making cider vinegar. S. C. VANDECAVEYE. Washington Agr. Expt. Sta., *Bull.* 202, 5-26(1926).—It is possible under the conditions described to make good cider vinegar of marketable strength in 6 months or less. The temp. should never exceed 75° F. by more than a few degrees because of the danger of losing alc. by evapn. Inoculation with pure cultures of yeast, *Saccharomyces ellipsoideus*, stimulated the alc. fermentation and checked the development of undesirable bacteria.

E. F. SNYDER

Influence of the physiological condition of yeast on the flavor of beer. J. RAUX. *Brasserie mullerie* 17, 181-3(1927).—A brief discussion bringing out the necessity of preventing incipient autolysis through defective storage conditions of the yeast.

A. PAPINEAU-COUTURE

Investigation into the composition of rums from the French colonies. X. ROCQUES. *Ann. Jav.* 20, 399-403(1927); cf. *C. A.* 21, 2355.—The changes noted in the compn. of rums produced at the present time, as compared with that of some yrs. ago, are attributed to improvements in fermentation technic, while modernization of distn. practice is not considered to have any great effect.

A. PAPINEAU-COUTURE

Utilization of molasses (Cross) 28. Alcohol as a by-product of paper manufacture (ANON) 23.

Drying yeast in mixture with purified cellulose. A. K. BALLS. U. S. 1,643,047, Sept. 20. Cellulose such as that derived from bran or rice polishings or plant fiber mixed with yeast (in such proportion, e. g., that it may comprise 30% of the product) and the mixt. is dried, suitably at a temp. of 20-40°.

Preparing molasses for yeast manufacture. R. KUSSEROW. U. S. 1,642,929 Sept. 20. Lactic acid bacteria are propagated in an alk. soln. of crude molasses to decompose colloids and form a ppt.

Propagating *Saccharomyces disjunctus* in a mash of crude West Indian cane molasses. A. K. BALLS. U. S. 1,642,192, Sept. 13.

17—PHARMACEUTICAL CHEMISTRY

W. O. EMERY

The varying alkaloid content of *Hyoscyamus niger* L. ZD. KLON. *Časopis Československého Lékařnictva* 5, 16-9, 33-7; *Chem. Zentr.* 1926, 11, 235.—The alkaloid content of different plants varies greatly, though plants growing luxuriantly contain no greater proportion of alkaloid than small plants. Plants which in their first yr. contain a high % of alkaloid become in their second yr. relatively poor in alkaloid, and vice versa. On the other hand, plants are found which vary little or not at all yr. by yr. It remains to be investigated whether these great variations depend upon the quality of the soil, the climate or other factors.

C. C. DAVIS

***Cannabis indica*, with special reference to the production of *Herba cannabis indicæ* of high quality through cultivation in Germany.** TH. SABALITSCHKA. *Heil Gewürzkräuter* 1926, 10 pp.; *Chem. Zentr.* 1926, 1, 2111.—A monograph dealing with the properties and use of Indian hemp (*Cannabis indica*), with its active principle, *cannabinol*, C₂₁H₃₅O₂, and particularly with the cultivation of this plant in Germany. Success was attained in growing at the expt. station in Happing (Upper Bavaria) a plant with a high protein content which furnished a rich and active ext. The plant is not particularly sensitive to cold and can be grown successfully anywhere in Germany where wheat

C. C. DAVIS

Detection and determination of small quantities of morphine in mixtures. L. VAN NELLE AND A. HARMSMA. *Mededeel. Rijks-Inst. pharmacotherapeutisch Onderzoek.* 1925, 2-4; *Chem. Zentr.* 1926, 1, 2612.—The sepn. of morphine must be carried out with due regard for the other ingredients in the mixt., typical examples of which are given. The most suitable method of detn. is reduction of HIO₄ and estn. of the color, which is influenced by addn. of NH₄OH. The following procedure is recommended: add 5 cc. of 5% aq. HIO₄ to 10 cc. of neutral or slightly acid aq. morphine soln., and after 3 min. compare the color with a series of solns. contg. known quantities of morphine.

C. C. DAVIS

Ferrous iodide-cod-liver oil. C. G. VAN ARKEL. *Pharm. Weekblad* **64**, 857-61 (1927).—This article of the Dutch Pharm. is prep'd. by dissolving I in cod-liver oil and shaking with Fe powder. FeI_2 is thus formed and is more or less sol. in the oil but not to the extent stated in the Pharm. The amt. of I and especially that of Fe taken up may be increased by allowing air access during the prepn. The action of the Fe and I on the oil causes certain changes which do not, however, consist in the addn. of I to the unsatd. fatty acids. Fe and I are not present in const. proportions in the product.

A. W. Dox

Examination of cubebs. A. J. STEENHAUER. *Pharm. Weekblad* **64**, 870-5 (1927).—A discussion of the pharmacognosy of *Piper cubeba* and the morphological characters which distinguish it from related species.

A. W. Dox

A German and an accompanying Dutch patent application for the manufacture of theobromine. O. P. A. H. SCHAAAP. *Pharm. Weekblad* **64**, 875-82 (1927).—The validity of the patent claim by the I. G. Farbenindustrie A. G., Frankfurt a/M, in which the use of alkali earth hydroxides or MgO is specified for the extn. of theobromine from cacao shells, is questioned on the ground of lack of novelty.

A. W. Dox

Papaver fruit and papaver sirup in connection with poisonings. A. J. STEENHAUER. *Pharm. Weekblad* **64**, 902-13 (1927).—In performing Pellagri's reaction for morphine it is advisable to add an excess of the alc. I soln. and then remove the I by $\text{Na}_2\text{S}_2\text{O}_3$. This makes it possible to detect 0.05 mg. morphine. For detn. the method of Mai and Rath and that of Georges and Gascard give comparable values. The morphine content of papaver fruits is quite variable, the max. being 0.5%. In the prepn. of papaver sirup according to the Dutch Pharm., all the morphine contained in the fruit goes into the sirup. When testing for small quantities of morphine by the Stas-Otto method clarification with $\text{Pb}(\text{OAc})_2$ is recommended.

A. W. Dox

Vanillin and piperonal as reagents for alkaloids. L. VAN ITALLIE AND A. J. STEENHAUER. *Pharm. Weekblad* **64**, 925-8 (1927).—Various aldehydes, e. g., CH_3O , BzH , chloral, bromal, paraldehyde and fufural, have been used as alkaloid reagents, but no mention has been made of vanillin or piperonal for this purpose. It is now shown that vanillin and piperonal give color reactions with a no. of alkaloids, especially morphine, codeine, apomorphine, aspidospermine and veratrine. The reddish violet color obtained by evapn. morphine with alc. vanillin and 2 N H_2SO_4 shows an absorption band with its center at $\lambda 560$. With alc. HCl in place of H_2SO_4 the color developed is a brownish green which becomes blue on addn. of H_2O , while with concd. HCl in the absence of EtOH the color is cherry-red. This last reaction is claimed to be suitable for colorimetric detn. of morphine. In all cases vanillin and piperonal give practically the same colors.

A. W. Dox

Decoctum chinæ. WILLY WOBBE. *Apoth. Ztg.* **42**, 981-2 (1927).—A commentary on the recent investigation of Awe (cf. C. A. **21**, 2957).

W. O. E.

Björklund ether test for oleum cacao. HANNS WILL. *Apoth. Ztg.* **42**, 982-3 (1927).—A renewed study of this test shows it to be inherently at fault in certain particulars. Thus, with an otherwise good oleum cacao a turbidity may appear after a lapse of 10 min. as the result of mech. impurities. The ethereal soln. of such samples should be filtered before application of a 2nd test, and following the Björklund procedure 3 g. of the sample are to be dissolved in 6 g. of Et_2O .

W. O. E.

Adulteration of drug plants in recent years. C. HAHMANN. *Apoth. Ztg.* **42**, 967-9 (1927).—The difficulties in the way of proper identification of sophisticated plant, leaf and flower material are emphasized, and some recent examples of adulteration enumerated, as *Origanum hirtum*, *Adonis vernalis*, *Marrubium vulgare*, *Galeopsis ochroleuca*, *Sweetia chirata* found contaminated with a variety of plant products. Belladonna, hyoscyamus, Stramonium, senna, pyrethrum and chamomile are cited as drugs frequently subjected to adulteration.

W. O. E.

Determination of potassium iodide in tincture of iodine. F. WEISS. *Apoth. Ztg.* **42**, 969 (1927).—A sample of tincture exam'd. by the official Ger. method and containing ether gave on analysis results indicating the presence of KI, although this substance was actually absent, as shown by the residue.

W. O. E.

Evaluation of liquid substitutes for blood. P. WOLFF. *Apoth. Ztg.* **42**, 1080-3 (1927).—Essentially a discussion of physiological salt soln. and the prepn. and application of its more recent substitutes.

W. O. E.

Estimation of potassium iodide in tincture of iodine. G. WARNECKE. *Apoth. Ztg.* **42**, 1039-40 (1927).—Into a small tared beaker weigh about 3 g. of the sample, heat gently over a wire gauze with a small flame, applying a current of air to the liquid to promote evapn. until finally all free I is eliminated. On cooling, det. the wt. of the

yellowish residue, then dissolve in H_2O and titrate with 0.1 N $AgNO_3$ soln. with $KCrO_4$ as indicator. W. O. E.

Testing medicine glass. W. V. BRUCHHAUSEN. *Apoth. Ztg.* 42, 1040(1927).—Exptl. evidence is adduced showing that while large and medium-sized containers may fulfill the Pharm. requirements perfectly, this would not be the case with the smaller sizes. Thus, a 30-cc. glass container yielded to 0.1 N HCl 2.5 times the amt. of alkali yielded by a 500-cc. container, a 50-cc. container twice the amt. W. O. E.

Artificial musk, its preparation, application, adulteration and control. ALFRED WAGNER. *Chem.-Ztg.* 51, 625-8(1927).—Some 30 different compds. are listed which possess a musk-like odor. The prepn. of musk *via* Baur, of xylene musk and and ambrette musk is discussed in connection with the app. used in their manuf. W. O. E.

Cultivation of belladonna, hyoscyamus and digitalis in China. J. C. LIU. *Ling-nam Agr. Rev.* 4, 37-42(1927).—Results of germination tests of belladonna show that untreated seeds require 4 weeks for germination, while those given an acid treatment germinate 10 days earlier. Acid treatment of seeds accelerates but does not increase the percentage of germination in the long run. Boiling the seeds for 3 min. kills their viability. The value of treating seeds with H_2O_2 is questionable. The viability of seeds is about 30%. Soil sterilization is distinctly valuable, as less mold is developed. The percentage of germination increases the most from the 5th to 7th week after sowing. In the cultivation tests of digitalis and hyoscyamus it develops that the soil and climate of North China are probably suitable for the cultivation of digitalis. Solanaceous plants do not thrive well on sandy loess soil, unfertilized with a plentiful supply of N as described in previous reports on wild plants. W. O. E.

Chemical reactions of synthetic perfumes. THOS. H. DURRANS. *Perfumery Essent. Oil Record, Special No. 18*, 307-34(1927).—An attempt has been made to indicate the manner in which synthetic perfumes are produced, and the complicated chem. reactions thereby involved. Thus, reactions initiated by Claisen, Cannizzaro, Bouveault and Blanc, Reimer-Tiemann, Grignard, Friedel-Crafts and others are discussed in a simple manner. Numerous examples also are cited in esterification, hydration, reduction, oxidation, halogenation and the manner of producing acetylenic carboxylic esters. W. O. E.

New rapid method for determining potassium iodide in the official German tincture of iodine. R. BERG AND M. TEITELBAUM. *Pharm. Ztg.* 72, 1060-1(1927).—*Free iodine*.—Dil about 2 g. of the sample with 5 to 10 cc. of H_2O in a flask with ground-glass stopper, and titrate the free I with 0.1 N $Na_2S_2O_3$ soln., 1 cc. of which = 0.012692 g. I . The normal consumption of the reagent should be 10.7 to 11 cc., which amt. corresponds to 6.8 to 7% free I . *Total iodine*.—To the soln. just titrated add about 30 cc. of C_6H_6 , shake vigorously, and without waiting for the emulsion to break add quickly in a single portion 10 cc. of satd. $Br-H_2O$, shake vigorously 5-10 sec., then immediately follow with 10 cc. of additional $Br-H_2O$. Shake 0.5 to 1 min., then titrate the liberated I with 0.1 N $Na_2S_2O_3$, without addn. of starch. If a is made to indicate the no. of cc. of $Na_2S_2O_3$ = the free I , while b stands for the amt. of $Na_2S_2O_3$ = total I , and c = amt. of sample taken, then the % of I = $1.2692 a/c$ and % of KI = $1.6602(b-a)/c$. The results obtained with several controls are given to show the accuracy of the method. W. O. E.

Sodium sulfide as applied in the German pharmacopeia. J. HERZOG AND K. SCHULZE. *Apoth. Ztg.* 42, 1078-80(1927).—In addn. to a discussion of this new reagent, several other reactions are considered involving the official salts of Bi . W. O. E.

Color tests for santonin. LAD. EKKERT. *Pharm. Zentralh.* 68, 545-6(1927).—If to several liquid portions, each contg. 2 cc. of 1% santonin soln. and 4 drops of 1% naphrole soln., 6, 4, 3, 2, 1.5 and 1 cc. of concd. H_2SO_4 are added, the resp. mixts. develop the following colors: currant-red; currant-red to ruby-red; currant-red to ruby to cherry red; rose, ruby, cherry, violet-red; rose, ruby, deep cherry, violet-red, red-violet, violet, blue-violet, violet-blue, dark blue; rose, ruby, almost blood-red. After addn. of the acid, the solns. should not be shaken, but allowed to stand quietly. After the lapse of several hrs. a mixt. of 1 cc. of santonin and 1 cc. of H_2SO_4 as above, as also one of 2 cc. santonin and 2 cc. H_2SO_4 , becomes blue. On substituting sucrose or levulose for naphrole, garnet-red solns. are obtained. W. O. E.

Some tests for the identification of luminal. CLÉMENT GENOT. *J. pharm. Belg.* 8, 331-5(1926).—A phys. and chem. study of luminal with special reference to properties which may serve in its identification. Descriptions are given of the cryst. forms deposited from soln. in H_2O , $EtOH$, dil. HCl , dil. NH_4OH , $AcOH$, $HCOOH$, $CHBr_3$, $AcOEt$, benzene, $C_6H_5CH_3$, HBr , concd. HNO_3 , $C_6H_5NH_2$, C_6H_5COOH , Me salicylate, $C_6H_5NO_2$, guaiacol, Et_2O , C_6H_6 , CS_2 , CCl_4 , xylene, amyl acetate, CH_3COCl ,

bromine water, amyl alc., HClO_4 , Ac_2O , perhydrol and creosote. A no. of microcryst. and 28 color reactions are also described. The article does not lend itself to abstracting and must therefore be consulted for details.

A. G. DuMEZ

Preparation of bismuth subgallate. A. SCHAMELHOUT. *J. pharm. Belg.* 8, 371-2(1926).—A convenient amt. of $(\text{Bi}_2\text{O}_3\text{CO}_3)_2 \cdot 2\text{H}_2\text{O}$ and a slight excess of gallic acid are introduced into a flask and a paste is formed by the addn. of H_2O . The flask is then placed in boiling water. When the reaction is completed the material is poured onto a force filter and washed with as little H_2O as possible. It is then dried on a porous plate at 30-35°. By this means, a uniform product citron-yellow in color is obtained.

A. G. DuMEZ

Some tests for the identification of chloralose. CLÉMENT GENOT. *J. pharm. Belg.* 8, 407-10(1926).—Chloralose ($\text{C}_6\text{H}_{11}\text{Cl}_3\text{O}_6$) is a hypnotic prepd. by the interaction of anhyd. chloral and glucose. It is a white cryst. substance having a bitter nauseating taste. Its soly. in 40 different solvents is given and the cryst. forms obtained from solns. made with 32 of these solvents are described. Some microcryst. and 25 color reactions are also described.

A. G. DuMEZ

Pepsin and the Belgian pharmacopeia. III. A. CASTILLE AND YVONNE POURBAIX. *J. pharm. Belg.* 8, 635-7, 651-3(1926).—C. and P. examd. samples of pepsin from different sources in the light of the standards prescribed by the Belgian Pharmacopeia III and reached the following conclusions: (1) None of the samples met the requirements of the Pharmacopeia. (2) Of the 7 samples examd., 4 did not meet the requirements of the pharmacopeias of the countries from which they came. (3) The requirements of the Belgian Pharmacopeia compared with those of other pharmacopeias are too rigorous. They should be modified to make them less prohibitive. (4) With this object in view C. and P. propose that the assay in the Belgian Pharmacopeia III be replaced by the following: Immerse in boiling water for 10 min. an egg from 2 to 10 days old. When cold sep. the white and rub it through a No. 10 sieve. Introduce 10 g. of this comminuted material into a mortar, add 0.1 g. of pepsin then, little by little during const. trituration, 60 cc. of distd. H_2O heated to 50° and contg. 3.5 cc. of official dil. HCl . Introduce the mixt. into a 250-cc. flask, using 40 cc. of distd. H_2O heated to 50° to rinse the mortar. Place the flask in a water bath and regulate the temp. so that the mixt. will be maintained at 45°. Shake the mixt. at 10-min. intervals. After 2 hrs. of digestion, pour the liquid in a 100-cc. graduated cylinder with a diam. of not over 3 cm. After standing 2 hrs. the deposit should not exceed 2 cc.

A. G. DuMEZ

Note on a Brazilian climber, "Soela Balle." N. WATTIEZ. *J. pharm. Belg.* 9, 545-9(1927).—Samples of a Brazilian plant, "Soela Balle," used as a tonic by the aborigines of that country, were identified by W. as a climber belonging to the genus *Strychnos*. The bark on extn. yielded neither strychnine nor curarine, but a mixt. of amorphous alkaloids possessing a stimulating action in small doses. The toxicity for frogs was 100 mg. per kg. body weight. An ext. of the bark marketed in Europe under the name "Refistine" represented about 5 times its weight of the dried drug and contained approx. 0.5 g. of alkaloids per 100 g.

A. G. DuMEZ

Digitonin—its properties, isolation and quantitative determination. I. S. MEL-LANOFF. *Am. J. Pharm.* 99, 390-401(1927).—Of the 6 diff. methods tried (digitonin-cholesterol, digitonin- α -naphthol, digitonin- β -naphthol, digitonin-thiophenol, digitonin-terpineol, digitonin-bromonaphthol) the best one was the digitonin-cholesterol. This method gave the highest results and showed that the addition compd. formed is the least sol. From an economical standpoint the digitonin- α -naphthol or the digitonin- β -naphthol method is the best. These pptg. agents cost least and can be easily sepd. from digitonin. The addition compd., when extd. with hot xylene or benzene, can be sepd. into its component parts. The pptg. agents are sol. in the above-mentioned solvents while digitonin is not. The quant. estn. of digitonin showed that there is about 1.4% in the seeds, 31.1% in digitalin (Merck) and 81.1% in digitonin (Merck). W. G. G.

Disinfectants from low-temperature tar. F. R. GREENBAUM. *Am. J. Pharm.* 99, 406-8(1927).—Combinations of low-temp. tar distillate and low- and high-boiling low-temp. tar phenols with rosin or castor oil soap were prepd. A drop of the so prepd. disinfectants formed a perfect white emulsion in H_2O , thereby clearly demonstrating that low-temp. tar is quite suitable for the prepn. of disinfectants. Its disinfecting properties are far superior to those obtained from ordinary aromatic tar. The emulsion, however, after a few minutes standing assumed a distinct red color. It was believed at first that an acid dye was being dealt with and the reactions of this dye pointed to the triphenylmethane group, and as it was an acid dye, it was believed to be either rosolic acid or a deriv. of rosolic acid. In spite of treatment with Na_2CO_3 which was supposed

to have removed the dye, the emulsion turned red. In coöperation with S. Caplan, G. went back to the oxidation theory, and it was assumed that the substance which caused the red color of the emulsion of the disinfectant is a polyhydroxyphenol. Burke and Caplan (*C. A.* 21, 814) continued to work on this problem and succeeded in isolating and identifying the polyhydroxyphenol and found it to be 3,4- or 3,6-dimethylcatechol. Very recently they developed a method by which they are able to remove this dimethylcatechol by treatment with Na borate without in any way changing the content of low-temp. tar phenols, so that today low-temp. tar can successfully be used for disinfectants which are superior in their phenol coeff. to the ordinary disinfectant from aromatic tar oil and which do no longer possess the objection of giving a red emulsion. W. G. G.

Further study of the tannin of *Heuchera americana* Linné. J. C. AND BERTHA L. DE G. PEACOCK. *Am. J. Pharm.* 99, 471-82 (1927).—A review, and revision in some particulars, of the results of an investigation of the root of *Heuchera americana*, published by one of the authors (J. C. B.) *Am. J. Pharm.*, April, 1891. Also in *J. Am. Pharm. Assocn.* 16, 729-37 (1927). W. G. G.

The comparative value of disinfectants. F. WEYRAUCH. *Centr. Bakt. Parasitenk. I Abt.* 103, 123-9 (1927).—A report of the strength of a no. of com. disinfectants. JOHN T. MYERS

Production of oil of citronella. W. BOBILIOFF. *Parfums de France* 5, 228-36 (1927) (in French and English); cf. *C. A.* 20, 3537.—Comparative distns. of cut and ment grass showed the former to give a higher yield of oil (0.79 as compared with 0.62%, av. of 5 tests); moreover, it allows of charging the still more heavily. Comparative tests by steam distn. and by water distn. (boiling in presence of considerable H₂O without introducing steam from an outside source) showed that the former gives a higher yield of oil (0.88% as compared with 0.82%) with higher total geraniol content (89.9% as compared with 88.7%); it is also cheaper and more easily controlled. Increase in steam pressure increases the yield of oil, but prolonged distn. at high pressure reduces the total geraniol content; as a general rule the pressure should not exceed 3 atm. (it may at times be necessary to use only 1-1.5 atm. to obtain 1-grade oil), and the time of distn. should be about 2 hrs. (for a still holding 500-1,000 kg. of grass). A. P.-C.

Citronella. JAS. PAUL JEANCARD. *Parfumerie moderne* 19, 166-71 (1927).—A description of the cultivation and distn. of citronella in Ceylon and Java and of the properties of the oils obtained. A. PAPINEAU-COUTURE

Oil of bastard lavender ("lavandin"). ANON. *Parfumerie moderne* 19, 191-4 (1927).—Three types of bastard lavender (hybrid of *Lavandula officinalis* and *L. spica*) gave oils with the following compn.: d 0.895-0.901, α -5.1 to -5.3°, n_D^{20} 1.4665-1.4697, esters 18.34-21.90%. A. PAPINEAU-COUTURE

Linalyl butyrates and the linalyl acetate content of lavender oil. A. KAUFMANN AND F. KJELSBERG. *Parfumerie moderne* 19, 198-200 (1927); cf. Dalton, *C. A.* 21, 798; Établissements A. Chiris, *C. A.* 21, 988; Parry, *C. A.* 21, 988; Langlais and Goby, *C. A.* 21, 1518.—Analysis of linalyl acetate, butyrate and isobutyrate. prepd. in the lab., gave the following results, resp.: ester content 97.0-98.5, 97.86, 94.49%; d_4^{20} 0.906-0.907, 0.8970, 0.8926; $[\alpha]_D^{20}$ -7.7 to -8.3°, -10.02°, -11.89°; n_D^{20} 1.450-1.451, 1.4518, 1.4487. The acetate is much more readily sapond. than either of the butyrates (which require 4-7 hrs. for complete sapon. under ordinary analytical conditions), and fractional sapon. of the above esters and of a no. of oils of different origins and known purity showed that the esters in the oil consist mainly (and at times practically entirely) of linalyl acetate. The largest amt. of butyrates found was 7.0% (calcd. from fractional sapon., but not otherwise identified) in an oil contg. 52.7% total esters, the other oils contg. 2-3% butyrates. The odor of the butyrates resembles that of lavender more closely than does the odor of the acetate; modern rapid steam distn. prevents decomposition of linalyl acetate which frequently took place in slow distn. over a naked fire, thereby lowering the relative proportion of butyrates to acetate in oils as now made. This may account for the fact that oil produced by modern distn. processes is frequently considered inferior in aroma to that obtained formerly. In an abs. lavender concrete obtained by extraction with volatile solvents, K. and K. found about 4.5% of methylumbelliferon, confirming A. Plau (*Perfumery Essential Oil Record* 18, 205-6 (1927)). A. P.-C.

Synthetic civetone and muscone. RENESTRAT. *Rev. chim. ind.* 36, 77-80, 116-51 (1927).—Review of recent work on the constitution and synthesis of muscone and civetone. A. PAPINEAU-COUTURE

Vegetable lactones having a musk odor. RENESTRAT. *Rev. chim. ind.* 36, 229-31 (1927).—Review of the work of Kerschbaum on the constitution of ambrettolide and of recent work on the musk-like lactone of essential oil of *Angelica*. A. P.-C.

Natural civet and musk. L. V. DOUAU. *Rev. parfumerie* 7, 276-80(1927).—Brief review of the present status of our knowledge of the constitution of *civettone* and *muscone*.
A. PAPINEAU-COUTURE

New remedies. W. F. ENGELHARDT. *Z. mediz. Chem.* 4, 51-2(1926); *Chimie et industrie* 18, 281(1927).—*Septamide* (Heyden) is the Mg deriv. of chloramine. It is a yellowish white cryst. powder, sol. in 50 parts of H_2O and has antiseptic properties.
A. PAPINEAU-COUTURE

Isacene. P. BERGELL. *Z. mediz. Chem.* 4, 65(1926); *Chimie et industrie* 18, 281(1927).—Isacene is a diacetyl bis-hydroxyphenylisatin and is closely related to phenolphthalein. It acts in doses of a few mg., 1 cg. being generally sufficient to regulate evacuation from the intestines, though up to 10 cg. may sometimes be required. Because of the smallness of the dose it has no effect on the stomach, and its use can be prolonged.
A. PAPINEAU-COUTURE

Alkaloid of the seeds of *Nandina domestica*, "nantenine." T. TAKASE AND H. OHASHI. *J. Pharm. Soc. Japan* No 535, 742-8(1926).—An alkaloid is isolated from seeds of *Nandina domestica* Thunb, which is quite different from nandinine isolated from the bark of the same plant. It is therefore called *nantenine*. It m. 138.5°, $[\alpha]_D^{17} = +111^\circ$. Detailed pharmacological effects of this alkaloid are given and compared with those of nandinine.
S. T.

Alkaloids of seeds of *Nandina domestica*. I. II. MANIWA, R. SAKAE AND I. KAN. *J. Pharm. Soc. Japan* No. 536, 833-42(1926).—From seeds of *Nandina domestica* was isolated an alkaloid of the compn. $C_{20}H_{23}O_4N$ (I, m. 138-9°. Since the properties of I are quite different from those of nandinine discovered by Eykmann (*Ber.* 17, 441 (1884)), in the bark and root of this plant, the name *domestine* is given to I. It has 2 MeO, a methylenedioxy, and an *N*-Me group; $[\alpha]_D^{20}$ 99.80°. It crystallizes in needles from petr. ether, and plates from H_2O soln. It is difficultly sol. in H_2O and petr. ether, sol. in alc, Et_2O , $CHCl_3$, Me_2CO , mineral acids and anhyd. AcOH. Its alc. soln. gives a rose-red color with concd. H_2SO_4 , later becoming dark in color. With HNO_3 it gives a dark brown color; with $FeCl_3$ soln. yellow-brown; other reactions with alkaloidal reagents are recorded. It is more toxic than nandinine. **Supplement.** *Ibid* 874.—Recently Kitasato (*Ibid* No. 534, 653) isolated another alkaloid, *domesticine*, $C_{19}H_{21}NO_4$ + 101.7°, which is very similar to I. By using Perkin's method K. prepd. *epi-dicentrine* and found it to be identical with domesticine methyl ether. Thus I is identical with K.'s domesticine methyl ether.
S. T.

Alkaloid of the seeds of *Nandina domestica*, Thunb. KITASATO. *J. Pharm. Soc. Japan* No. 536, 843-4(1926).—Takase and Ohashi isolated an alkaloid (cf. 2nd preceding abstract) from the seeds of *Nandina domestica* Thunb, and named it nantenine. Although the m. p. and $[\alpha]$ were given, no elementary analysis was reported. Maniwa, Sakai and Kan, on the other hand (cf. preceding abstract), isolated the same alkaloid from the seeds, but named it domesticine. K. isolated (cf. *Ibid* No. 534) another alkaloid, domesticine, from the same seeds, and by synthesizing its methyl ether detd. its structure. Since the m. ps. of domesticine methyl ether (m. 139°), nantenine (m. 138.5°), and domesticine (m. 138-9°), and their $[\alpha]$ are very similar, they might be the same compd. When M.'s domesticine and K.'s domesticine methyl ether are heated together, there is no change in m. p. Nantenine also must be identical with K.'s domesticine ethyl ether (former has $[\alpha] + 101.7^\circ$, and the latter, + 111°). Although the name nantenine had been introduced before K.'s domesticine was suggested, it was applied to an alkaloid isolated from the bark of the plant by Shibata. Thus domesticine methyl ether should be used instead of nantenine. The credit of discovery of natural domesticine methyl ether must go to T. and O., and M.; and T. and O.'s discovery that it is entirely different from nandinine in pharmac action should be properly acknowledged.
S. T.

Invert sugar sirup. W. A. WHATMOUGH. *Chemist & Druggist* 106, 281(1927).—These sirups used during the War as a substitute for glycerol are recommended to replace simple sirup, *Brit. Pharm.* They are best prepd. by the action of invertase on cane sugar solns., contain 80% sugars (*Brit. Pharm.* 66%), d 1.4 (*Brit. Pharm.* 1.33), are more viscous, sweeter, enhance delicate flavors, flow freely at low temps., and neither cake nor crystallize. Examples of pharmaceutical uses, *e. g.*, in cough sirups, are given. Admixt. with acid galenicals, also contact with sucrose crystals, should be avoided.
S. WALDBOTT

High-density sirup for pharmaceutical use. W. A. WHATMOUGH. *Pharm. J.* 118, 724, 789-90; *Chemist & Druggist* 107, 18-9, 115(1927); cf. preceding abstract.—The sirup (d. 1.40), contg. sucrose 40%, dextrose 20%, levulose 20%, H_2O 20%, is recommended for pharmaceutical use. For its prepn. from the pure (opaque) 82% invert

sugar sirup (A), melt together on the water bath A 5 parts with H_2O 1 part, add pure sucrose 4 parts, stir until dissolved; no sucrose crystals must remain in the finished product. Crystn. of the sirup is prevented by the hygroscopicity of the levulose; fermentation caused by wild yeasts is prevented by high density of the sirup. A number of pharmaceutical applications are indicated. S. WALDBOTT

A modern sirupus. W. A. WHATMOUGH. *Chemist & Druggist* 106, 675(1927).—"Nulomoline" is a non-crystg., non-fermentable invert sugar sirup, useful as a substitute for clarified honey in pharmaceutical prepn.s. The com. opaque variety used in confectionery contains 82% invert sugar, 18% H_2O ; dextrose is crystd. at ordinary temp., but is dissolved at 50–60°. The clear variety, "Nulomoline Pharmaceutical," is a mixt. of invert sugar 40%, sucrose 40% and H_2O 20%, recommended to take the place of "sirupus, Brit. Pharm.," in pharmaceutical prepn.s. S. WALDBOTT

Linimentum aconiti compositum, Brit. Pharm. Codex. ANON. *Chemist & Druggist* 106, 711(1927); cf. W. Forster, *Ibid* 105, 920(1926).—A sepn. noted by F. in this liniment was caused by $CHCl_3$ and was avoided by addn. of H_2O . Accordingly, an improved prepn., *linimentum sedativum* (North of England Med. Formulary), has the compn.: Lin. aconiti 6 drachms, Lin. belladonnae 6, $CHCl_3$ 2, H_2O 2 drachms. As no sepn. will take place in this prepn., its alkaloidal content will be const. S. W.

Vanishing creams for the skin. C. DOUBLEDAY. *Chemist & Druggist* 106, 780–1; 107, 62, 89–90(1927).—Formulas and practical directions are given for the compounding of skin creams. S. WALDBOTT

The new Roumanian pharmacopeia, 4th ed. ANON. *Chemist & Druggist* 106, 789(1927); cf. C. A. 21, 1522.—The phys. and chem. consts. of the official essential and fixed oils and the 3 official balsams are given in tabular form. S. WALDBOTT

A new emulsifying plant. W. A. WHATMOUGH. *Chemist & Druggist* 106, 844(1927).—Describes the mode of action of the "Premier emulsifying machine" with sketch of detail, and illustration of app. adapted for pharmaceutical use. S. W.

A propos the physiologic control of neoarsenobenzenes. L. LAUNOY. *Compt. rend. soc. biol.* 97, 324–7(1927).—This is mainly a discussion of previous work by the author and others. The mouse is recommended in place of the rabbit for standardizing the dose of neoarsenobenzenes. L. W. RIGGS

Assay of glycerophosphates by the method of Copaux. PAUL FLEURY and ZAHARIE SUTU. *J. pharm. chim.* 5, 56–62(1927); cf. Copaux, C. A. 16, 219.—The method, modified, permits detn. of total P in glycerophosphates (A) of Ca and Na and the granulated saccharate prepn. (Codex), after mineralization of the P by the methods of Fontès and Thuville (cf. F. and S., C. A. 21, 2713). The app. is a 60-cc. ampoule with a 10-cm. stem of 1.5 cc. total vol., graduated into 0.05 cc., each indicating about 1 mg. P_2O_5 . The reagents are: Na molybdate soln. (B) (dissolve MoO_3 100 g. in hot soln. of Na_2CO_3 (32 g.), fill up to 1 l.); Et_2O free from $EtOH$, d. 0.720; type soln. of KH_2PO_4 (3.778 g. per l. = 2 g. P_2O_5 per l.). Put 10–15 cc. of the soln. contg. the total mineralized P (not to exceed 30 mg. P_2O_5) into the app., add 3 cc. HNO_3 (d. 1.332) and Et_2O until after shaking, a 3–4-mm. layer of Et_2O is formed. Now add soln. B in 3 cc. fractions until after shaking and centrifuging for 1 min., 2 successive addns. leave the vol. of the yellow layer unchanged. Repeat this with the type soln. and det. the P content from the ratio of the 2 vols. For 30 mg. P_2O_5 , 15–17 cc. of B, for 2–4 mg., 5–10 cc. of B are required. The av. error by this method in 6 detns. was –0.4%. The method also allows direct detn. of H_3PO_4 in presence of A, since the reagents used do not hydrolyze A under the conditions of the detn. However, complete sepn. of 2 mg. P_2O_5 (present as H_3PO_4) from e. g., 1 g. Na-A or its equiv. of Ca-A, dissolved in 15 cc. H_2O , requires 12–13 cc. of soln. B instead of only 3–5 cc. used when H_3PO_4 is absent. S. WALDBOTT

Solution of ammonium acetate, Brit. Pharm. NOEL L. ALLPORT and T. TUSTING. *Pharm. J.* 118, 719–21, 788–9; *Chemist & Druggist* 107, 15–6(1927); cf. C. A. 21, 1522.—The Brit. Pharm. directs the prepn. of $AcONH_4$ by "neutralizing" dil. $AcOH$ with NH_4 carbonate. No method for checking the NH_3 or $AcOH$ contents of the product is given; nor is there any test for neutrality. Interpreting this word literally, the reaction should be that of abs. neutrality, i. e., $p_H = 7.0$. At this val., the soln. will contain NH_4HCO_3 and CO_2 in addn. to $AcONH_4$. This is shown (Table I) by a detn. of total $AcOH$, total NH_3 and total CO_2 in 3 solns. made from $AcOH$ and NH_4 carbonate, brought, resp., to p_H 7.0, 7.6 and 8.0; another soln. to 7.0 by simple neutralization with NH_4OH ; the latter product thus contains the theoretical equivs. of $AcOH$ and NH_3 . The excess of NH_3 at the 3 values of p_H named is, resp., 5, 7.6, 10.7%. Calcg. the ratio NH_4HCO_3/H_2CO_3 shows that at p_H 7.0 about 50%, at 7.6 100%, at 8.0 none of the H_2CO_3 is free; it then exists entirely in the form of NH_4HCO_3 .

Similar detns. (Table II) are made on a NH_4AcO soln. prepd. by 1:7 diln. of the well-known "concd. soln." The quantities of NH_3 at the above p_H are much less (1.26, 1.9, 4.4%), as the soly. of CO_2 in the concd. soln. is not proportional to the concn.; hence the dild. soln. contains less CO_2 , requiring less NH_3 to change the p_H . Conclusion: For dispensing purposes, a more satisfactory soln. than that of the Brit. Pharm. may be made by adjusting the reaction to p_H 8.0 by adding a soln. of NH_4OH to a soln. previously neutralized to p_H 7.0 by means of NH_4 carbonate. The reaction of solns. "neutralized" by the use of litmus may vary from p_H 6.5 to 7.5, and such solns. could be considered as having been prepd. according to the present Brit. Pharm. instructions.

S. WALDBOTT

A color test for ergot alkaloids. NORMAN EVERS. *Pharm. J.* **118**, 720-3, 789; *Chemist & Druggist* **107**, 16-7 (1927) - Tanret's color test (1875) (cf. Tschirch C. A. **21**, 1870) is modified in order to obtain the color in a homogeneous soln. so as to be measurable in a tintometer. For ext. ergotac liq., mix 2 cc. of the sample with 1 cc. of 10% NH_4OH and shake with 15, 10 and 5 cc. Et_2O . Filter and evap. the Et_2O soln. To the residue add 15 cc. glacial AcOH , filter and mix 4 cc. of the filtrate with 4 cc. of 50% H_2SO_4 by vol. The violet blue color is fully developed in about 12 hrs., and is stable for 24 hrs. longer. Addn. of FeCl_3 or of H_2O_2 is detrimental. In testing ergot, shake 2 g. of powd. ergot for 2 hrs. with 1 cc. of 10% NH_4OH , 2 cc. H_2O and 40 cc. Et_2O , and finish as before. A table gives the color results in Lovibond units, parallel with the results of physiol. assay of exts. standardized against ergotoxine. Well-marked colors are given by exts. contg. 0.065% of alkaloid. A negative color test always indicates an inactive prepn., although a positive color test is sometimes produced with such a prepn. It applies the color test also to known and varying quantities of ergotoxine and ergotinine. The resulting graphs, very similar to each other, show approx. proportionality between quantities of alkaloid and of color.

S. WALDBOTT

The volumetric assay of iodides. A. J. JONES. *Pharm. J.* **118**, 723-4; *Chemist & Druggist* **107**, 17-8 (1927).—In the place of the non-sp. method of the Brit. Pharm., the method of titration with HIO_3 soln. (L. W. Andrews, *J. Am. Chem. Soc.* **25**, 756 (1903)) is recommended, which detns. I in KI in the presence of large quantities of other halogenides. The reaction, in the presence of excess of HCl , is $2\text{HI} + \text{HIO}_3 + 3\text{HCl} \rightarrow 3\text{H}_2\text{O} + 3\text{ICl}$, taking place in 2 stages: (a) $10\text{HI} + 2\text{HIO}_3 \rightarrow 12\text{I} + 6\text{H}_2\text{O}$; (b) $3\text{HIO}_3 + 15\text{HCl} \rightarrow 3\text{I} + 15\text{ICl} + 9\text{H}_2\text{O}$. To 0.5 g. KI (or its equiv. of other iodides) add 10 cc. H_2O and 40 cc. HCl (d 1.16), then 0.1 N KIO_3 (10.701 g. KIO_3 per l.) until I, first increasing, disappears. While still brownish, add 5 cc. CHCl_3 and shake after addn. of each drop of the KIO_3 soln. until the pink color in the CHCl_3 disappears, the supernatant liquid has the bright yellow color of ICl . The method gives accurate results in an equimol. mixt. of bromide and iodide. Four com. samples of KI, in which Br and Cl were also detd., indicated by the Brit. Pharm. method 103.68, 102.06, 99.60, 98.97% KI; by the KIO_3 method, 96.28, 97.67, 99.17, 98.83% KI. By this method, HgI_2 may also be detd.; use 0.6-0.7 g., add 10 cc. H_2O and 40 cc. HCl as before. The HgI_2 will be completely dissolved before the CHCl_3 is to be added. The recent Spencer method (C. A. **21**, 2628) has not yet established non-interference of bromides.

S. WALDBOTT

The plastic behavior of tragacanth mucilage, and its pharmaceutical significance. G. MIDDLETON. *Pharm. J.* **118**, 727-30, 790; *Chemist & Druggist* **107**, 20-1 (1927).—The app. is described by means of which viscosity and plasticity of tragacanth mucilage are measured. The behavior of this mucilage resembles that of other emulsoids in showing a viscosity varying with the rate of shear. Typical flow-pressure curves are given. A standardized shot test is recommended for evaluation of the gum (cf. Evers and McLachlan (C. A. **18**, 3103)). The behavior of the mucilage in its pharmaceutical applications is discussed. The further study of probable variations in the plasticity curve of tragacanth mucilage with changes in concn. and temp., with addn. of acacia or alkali, etc., is contemplated.

S. WALDBOTT

A short note on Catechu pallidum. C. J. JORDAN. *Pharm. J.* **118**, 730-1, 790; *Chemist & Druggist* **107**, 21-2 (1927).—Of 12 com. samples examd., only 4 gave results approx. those required by the Brit. Pharm.; hence the com. drug is rarely of Brit. Pharm. quality.

S. WALDBOTT

Tobacco; cultivation and fertilization. P. DE SORNAY. *Rev. agr. Maurice* **4**, 44-8 (1927).—Ash analyses of tobacco from 3 different fields are presented, and on this basis the use of phosphate guano instead of acid phosphate is recommended. This should be applied before planting, and should be supplemented at planting and again 1 month later by a mixt. of NaNO_3 , KNO_3 and $(\text{NH}_4)_2\text{SO}_4$. Advice is also given concerning the optimum distance between plants.

F. W. ZERNAN

Treatment of tobacco by the hot-air process, and directions for the construction of the necessary-drying chambers. G. CORBET. *Rev. agr. Maurice* 4, 51-3(1927).

Papain. P. DE SORNAY. *Rev. agr. Maurice* 4, 54(1927).—Directions are given for collecting and drying the latex of the papaya fruit, rich in papain. F. W. Z.

ASKINSON, H.: *Le manuel du parfumeur*, 4th ed., revised by R. Sornet. Paris: Gauthier-Villars & Cie. 141 pp.; 18 francs. Reviewed in *Rev. prod. chim.* 30, 483; *Chemistry & Industry* 46, 834(1927).

CRAVERI, C.: *Essence naturali (oli essenziali)*. 2nd ed. Milan, 1927; U. Hocpli. 759 pp.; 34 lira (bound). Reviewed in *Rev. prod. chim.* 30, 569(1927).

JEANCARD, PAUL: *Les parfums; chimie et industrie*. Paris: J. B. Baillière & Fils. 387 pp.; 80 francs (+ 10% mailing charges). Reviewed in *Rev. prod. chim.* 30, 570(1927).

WIESNER, JULIUS VON, et al.: *Die Rohstoffe des Pflanzenreiches*. Vol. I. Alkaloids to Yeasts. 4th ed. Dresden: Paul Kraus; Berlin-Dahlem: Wilhelm von Brehmer. 1122 pp. Bound, M. 49; sewed, M. 46. Reviewed in *Am. J. Pharm.* 99, 440-2(1927).

Butylresorcinol. A. R. L. DOHME. Can. 272,351, July 12, 1927. A new product butylresorcinol, white crystals, m. 47-8°, slightly sol. in H₂O and readily sol. in alc., benzene and vegetable oil, and with a phenol coeff. of about 22.

Basic bismuth salts of aryl-arsonic acids. R. W. E. STICKINGS. Can. 273,216, Aug. 16, 1927. A basic Bi salt of *N*-phenylglycinamide-*p*-arsonic acid is manufd. by optg. the soln. of an alkali bismuthyl tartrate with an alkali salt of *N*-phenylglycinamide-*p*-arsonic acid in an excess of at least 25% over the quantity equiv. to the mother Bi salt.

Complex antimony compounds. I. G. FARBEINDUSTRIE AKT.-GES. Brit. 262,301, Feb. 15, 1926. A neutral salt of a mercaptocarboxylic acid is reacted on with an antimonyl compd. of a polyphenol or deriv. contg. 2 OH groups in *o*-position to each other. The products are *therapeutic agents*. The Na salt of thioglycollic acid may be treated with the antimonyl compds. of pyrocatechol, pyrogallol and gallic acid. The antimonyl compd. of gallic acid is made by heating Na gallate with Sb₂O₃. Cf. C. A. 21, 594.

Therapeutic vaccines, serums, etc. C. RATH. Brit. 262,080, Nov. 24, 1925. Chem. substances capable of influencing pathogenic microorganisms, as described in Brit. pat. 247,965 (C. A. 21, 626), are caused to act *in vitro* on cultures of spirochetes, trypanosomes, cocci or the like instead of being injected into an animal together with the microorganisms. The treated organisms become non-virulent and may be further weakened, e. g., by heating. The preps. may be used directly for immunizing or may be injected into an animal for obtaintment of immunizing serums, etc.

Pharmaceutical product. W. SCHULEMANN, F. SCHONHOFER, A. WINGLER and F. MIERZSCH. Can. 271,590. June 14, 1927. Polyamino quinoline derivs. and intermediate products for their manuf. consist of the respective amino derivs. being made strongly basic by the introduction of N atoms which are combined with the aromatic amino groups through the medium of aliphatic radicals. Cf. C. A. 20, 3333.

Sterilizing agents. C. H. H. HAROLD. Can. 272,013, June 28, 1927. A sterilizing agent is prepd. by adding to an aq. soln. of NH₃ of a concn. not greater than about 0.0125 per l., the equiv. quantity of Cl₂ corresponding to the formation of a chloramine with the total NH₃ present. Cf. C. A. 20, 1877.

Fumigant. R. N. CHAPMAN. Can. 273,260, Aug. 23, 1927. A fumigant composes CCl₄ and CCl₃NO₂ in equal parts by vol.

Medicinal plaster for use in the mouth. A. D. GOLDSTEIN. U. S. 1,642,653, Sept. 13. Thin strips are formed of an agar glycerol mixt. or similar material uniformly permeated with medicaments, e. g., with oil of cinnamon, ZnCl₂ or mercurichrome.

18—ACIDS, ALKALIES, SALTS AND SUNDRIES

FRED C. ZEISBERG

The volumetric and thermic relations of contact sulfuric acid. ROBERT NITZSCHMANN. *Continental Met. Chem. Eng.* 2, 176-8(1927).—In the roasting of Zn blende, Fe pyrite and S according to the equations $2ZnS + 4O_2 = 2ZnO + 2SO_2$, $4FeS_2 + 15O_2$

$= 2\text{Fe}_2\text{O}_3 + 8\text{SO}_3$, and $2\text{S} + 3\text{O}_2 = 2\text{SO}_3$, equations are given for the calcn. of the vols. of the gases, O_2 , N_2 and SO_2 after absorption of the SO_3 , as a function of the % conversion and the % SO_2 in the initial burner gas. *Ibid* 208-9(1927).—Graphs and tables of data are given for: the heat content of roaster gases (from Fe pyrite) as a function of the theoretical temp. of combustion; the max. temp. difference between the gases entering and leaving the converter as a function of the % conversion; the temp. of the gases coming from the contact catalyst as a function of the % conversion; and the relations of the exchange of heat up to the emission from the catalyst. J. H. PERRY

Production of nitric acid by the catalytic oxidation of ammonia. V. I. MALYAREVSKII. *Ukrainskii Khim. Zhurnal* 1, 97-140(1925); *Chem. Zentr.* 1926, II, 286.—A detailed description of the recovery of NH_3 in coking plants. C. C. DAVIS

Catalytic oxidation of ammonia. V. I. MALYAREVSKII. *Ukrainskii Khim. Zhurnal* 1, 141-63(1925); *Chem. Zentr.* 1926, II, 286; cf. preceding abstract.—The paper deals with the work of Malyarevskii and Malyarevskaya (cf. C. A. 20, 971). C. C. DAVIS

The Carrara process for the synthesis of ammonia. ANON. *J. four elec.* 36, 197(1927) — A short note. W. P. G. Carrara uses pressures around 150 atm. vs. 300 by Fauser, 500-700 by Casale, 200 by Haber and 1000 by Claude. There is less danger of explosion. The first product is a soln. of 20-5% NH_3 . The Carrara process is particularly applicable to small scale operation. At Padova, Italy, N from liquid air and electrolytic H are used. The compn. of the catalyst is not revealed. C. G. F.

Preparation of aldehyde-ammonia. V. SOROKIN. *J. Chem. Ind. (Russia)* 2, 64-6(1925); *Chem. Zentr.* 1926, II, 826 — Aldehyde ammonia is used under the name of "Vulkazit A" in the vulcanization of rubber. It is obtained in 93-95% yield by leading HCHO and NH_3 vapors into a large vessel. The NH_3 must be in excess, otherwise the product is yellow, and the temp. must be maintained below 30° . A 90% yield is obtained from 10% HCHO in conc. acetone with a slight excess of aq. NH_3 . C. C. D.

Liquid caustic soda. R. J. QUINN. *Oil Fat Ind.* 4, 289-97(1927).—This is a discussion of advantages of handling caustic soda in liquid form. E. SCHERUBEL

Ammonium thiocyanate from coking plants. W. GLUUD AND W. KLEMP. *Z. anorg. Chem.* 40, 659-60(1927).—The possibility of prep. large amts. of thiocyanates in the coke industry, both cheaply and easily, has not been fully realized. The principle of the thiocyanate method rests upon washing the gas, freed from tar and contg. NH_3 , H_2S and HCN , with an aq. suspension of S, and allowing time for the HCN to react with the ammonium polysulfide, resulting in the formation of NH_4SCN . This method was put into practice in a semi works, exptl. plant, and observed carefully in large scale operation. The increase in concn. of the NH_4SCN in the soln. was found to be uniform throughout. Increasing the temp. of the soln. during the washing gave solns. of higher concn. If the washing was conducted correctly, it was not difficult to obtain pure NH_4SCN from the soln. LOUISE KELLEY

The conversion of alkali chlorides into nitrates with simultaneous production of chlorine. VALENTIN DOMINIK. *Chimie et industrie* 18, 24-32(1927).—The purpose of the investigation was to det. the conditions under which cheap NaNO_3 could be obtained from synthetic HNO_3 and NaCl , the main difficulties of the problem lying in the working up of the mother-liquor from the sepn. of NaNO_3 , the complicated sepn. of the gaseous products of the reaction, and the selection of a sufficiently resistant material for the equipment. The conditions under which the reaction $\text{HNO}_3 + 3\text{HCl} \rightleftharpoons 2\text{H}_2\text{O} + \text{Cl}_2 + \text{NOCl}$ can be made to proceed towards the right are studied. The proportion of NaCl and concn. of HNO_3 can be selected so that distn. gives gaseous products (Cl_2 and NOCl), water, and a residue consisting of concd. HNO_3 holding the NaNO_3 in soln. The behavior on distn. of a mixt. of NOCl and Cl_2 (liquefied by cooling the distn. gases in liquid air) showed that the 2 gases do not combine under the conditions of the expts. and do not form a soln. with const. b. p., so that they can be sepd. completely by fractional distn. The soly. coeff. of NOCl in HNO_3 (d. 1.40) at 18° was found to be 36.1; and of Cl_2 at 21° , 1.82. NOCl may be converted into HCl , HNO_3 and NO in the absence of air according to the equation $3\text{NOCl} + n\text{H}_2\text{O} = 3\text{HCl} + \text{HNO}_3 + 2\text{NO} + (n-2)\text{H}_2\text{O}$ (1), or into HNO_3 and HCl in the presence of air according to equation $2\text{NOCl} + 2\text{H}_2\text{O} + \text{O}_2 = 2\text{HNO}_3 + 2\text{HCl}$ (2). Reaction (1) is particularly indicated in plants making synthetic HNO_3 , the NO being returned to the mixt. of N oxides and air; and in such a case the production of NaNO_3 may be represented by the equation $4\text{HNO}_3 + 4\text{NaCl} + \text{O}_2 = 4\text{NaNO}_3 + 2\text{Cl}_2 + 2\text{H}_2\text{O}$. Tests with Krupp's ferro-Si known as "thermisilid extra" showed it to be practically unaffected by boiling aqua regia. Application of these results to the continuous production of NaNO_3 and the advantages of

converting the Cl_2 to HCl and combining with NH_3 (also produced in the N-fixation plant) are discussed.

Molten ammonium chloride. WALTER MERTNER. *Chem.-Zig.* 51, 638(1927).— NH_4Cl was heated to 400° in a sealed glass tube. The white clouds formed at first disappeared gradually and the crystals showed the typical phenomena of melting until nothing but a mobile liquid remained. Upon cooling a hard vitreous mass was left, similar to com. "sublimed sal ammoniac," and it is claimed that the latter may really have been formed by distn. under pressure, rather than by sublimation. W. C. F.

Conversion of sodium chromate to dichromate with the aid of carbon dioxide. N. F. YUSHKEVICH AND M. N. LEVIN. *J. Chem. Ind. (Russia)* 2, 329-32; *Chem. Zentr.* 1926, I, 3390.—The possibility of converting Na_2CrO_4 to $\text{Na}_2\text{Cr}_2\text{O}_7$ by CO_2 under pressure, which has already been proved in earlier work (*C. A.* 21, 1525), is established in further expts. When Na_2CrO_4 soln. contg. 16.98% Cr is maintained 5 hrs. at 23° under a CO_2 pressure of 4 atm., 66% of the Cr is converted to $\text{Na}_2\text{Cr}_2\text{O}_7$. With shorter time the yield is smaller, probably because satn. of the soln. with CO_2 proceeds slowly. Under 8 atm. pressure of CO_2 , the reaction is complete in 2 hrs., a 14.3% (calcd. as Cr) soln. being converted to the extent of 65%. By concg. the final soln., part of the Na_2CrO_4 seps. and the ratio of Cr as $\text{Na}_2\text{Cr}_2\text{O}_7$ to total Cr increases to 0.77. By treatment of this concd. soln. with CO_2 under 8 atm. pressure, this ratio further increases to 0.85. To complete the conversion to $\text{Na}_2\text{Cr}_2\text{O}_7$, the soln. must then be acidified with H_2SO_4 , but by this method the consumption of H_2SO_4 and the formation of Na_2SO_4 as by-product are only about 0.2 of the quantities when H_2SO_4 is the only agent used for the conversion. Likewise only 0.5 the soda is used. C. C. DAVIS

Reciprocal system: water, sodium chloride, magnesium sulfate, magnesium chloride, sodium sulfate. A. KUPFER. *Caliche* 8, 467-87(1927).—Triangular and rectangular graphs, soly. tables and text describe isotherms of this system from 0° to 55° , giving the soln. compn. at the transition points. Soly. tables also are given from 0° to 100° for each of the 4 primary salts alone. J. HOWARD FLINT

Quaternary system: water, sodium nitrate, sodium chloride, sodium sulfate between 100° and 0° . A. CHRETIEN. *Caliche* 8, 390-408(1926).—This system is discussed in graphs and tables. At 68.5° the soln. is satd. with respect to chloride, nitrate, anhydrous sulfate and $\text{Na}_2\text{SO}_4 \cdot \text{NaNO}_3 \cdot \text{H}_2\text{O}$ (darapskite); this last can exist in the presence of the others down to 7.2° . Above 68.5° it is not formed when the soln. is satd. with NaCl , as in lixiviating caliche. Above 78.5° the sulfate is anhydrous, and below 7.2° is decahydrate in contact with solus. satd. also with simple nitrate and chloride only. At 16° there are four solid phases, chloride, darapskite, anhydrous sulfate and sulfate decahydrate. J. HOWARD FLINT

Quantitative relations in the "ocher" process for producing copper sulfate. G. AGDE AND H. BARKHOLT. *Metall u. Erz* 24, 49-52(1927).— CuSO_4 soln. is made from 30° B ϕ . H_2SO_4 flowing over Cu, with a counter current of air and steam in a Pb-lined concrete tower. Data are given for the yields with different acid concn. and temp., and for crystn. Crystn. from acid soln. is advised, but the temp. and concn. must be carefully regulated to avoid hydrates with less than 5 mols. water. C. G. K.

The production of magnesia from dolomite. LUDWIG KIEPENHEUER. *Zement* 15, 471-5(1926).—Calcined dolomite is treated with Na_2CO_3 soln. and CO_2 under pressure to form the double salt $\text{MgNaH}(\text{CO}_3)_2$ in soln., the CaCO_3 remaining undissolved. MgCO_3 is pptd. from this soln. by reducing the pressure of CO_2 . H. F. K.

Factors influencing the loss of iodine from iodized salt. A. H. JOHNSON AND B. L. HERRINGTON. *J. Agr. Research* 35, 167-83(1927).—In the absence of sunlight iodized salts undergo no serious loss of I when stored in atm. up to at least 50% relative humidity. Exposure of the salts to sunlight results in a considerable loss of the I present. This loss of I by the action of sunlight may be reduced by rendering the salt alk. with NaHCO_3 , and entirely prevented by iodizing the salt with KIO_3 . Exposure to heat alone effects losses of I from acid, neutral and alk. iodized salts, and from salt iodized with KIO_3 in the same order as exposure to sunlight. The quantity of I liberated from a neutral salt iodized with KI appears to depend on the quantity of KI present. W. H. ROSS

The heavy inorganic industry in Spain. J. UTHOFF. *Quim. ind.* 4, 156-63(1927).—Statistics. MARY JACOBSEN

Sodium salts. A. G. WIKOFF. *Mineral Ind.* 35, 616-26(1926).—A review of production and trade in salt, nitrate, sulfate and carbonate. A. BUTTS

Borax. PAUL D. V. MANNING. *Mineral Ind.* 35, 90-4(1926).—Sources and uses, and the domestic and foreign industry are treated. A. BUTTS

Bromine and iodine. ANON. *Mineral Ind.* 35, 95-9(1926).—Sources and production are covered, with an account of the technology of I extrn. A. BUTTS

Manganese. CHAS. H. BEHRE, JR. *Mineral Ind.* 35, 444-60(1926).—A discussion of production, consumption and technology, with bibliography. A. B.

Antimony. K. C. LI. *Mineral Ind.* 35, 48-53(1926).—Production and market are reviewed. A. BUTTS

Arsenic. H. W. AMBRUSTER. *Mineral Ind.* 35, 54-65(1926).—A discussion of production and consumption of As and compds., including new processes and uses. A. BUTTS

Barium and strontium. CHARLES HARDY. *Mineral Ind.* 35, 83-7(1926).—A statistical discussion of the Ba and Sr industries. A. BUTTS

Selenium and tellurium. S. SKOWRONSKI. *Mineral Ind.* 35, 611-5(1926).—Production and new uses are discussed, with bibliography. A. BUTTS

Sulfur, pyrite and sulfuric acid. A. E. WELLS. *Mineral Ind.* 35, 627-41(1926).—Production, consumption, and technology are discussed, with statistics. A. B.

Bismuth. C. P. LINVILLE. *Mineral Ind.* 35, 88-9(1926).—Production, prices, and imports are given. A. BUTTS

Fluorspar. H. W. DAVIS. *Mineral Ind.* 35, 247-51(1926) - U. S. and foreign production are treated. A. BUTTS

Fluorspar and cryolite in 1926. H. W. DAVIS. *Bur. Mines, Mineral Resources of U. S. 1926*, Part II, 17-49(preprint No. 4, published Aug. 6, 1927). E. H.

Feldspar. A. S. WATTS. *Mineral Ind.* 35, 244-6(1926) - A review of the industry. A. BUTTS

Gypsum. F. A. WILDER. *Mineral Ind.* 35, 335-40(1926).—A review of production and use of gypsum. A. BUTTS

A comparison of the economics of the kettle and rotary furnace methods for calcining gypsum. B. SAGEBARTH. *Chem. Ztg.* 51, 588-9(1927).—The rotary furnace method for calcining gypsum is definitely more economical than the kettle method, mainly because of the continuity of operation and the direct heating methods involved, e. g., the fuel consumption in producing 1000 kg. was 55 kg. of coal as compared with 75 kg. with the kettle. Diagrams of modern equipment are given. H. L. OLIN

Phosphate rock. K. D. JACOB. *Mineral Ind.* 35, 512-29(1926).—Includes world production and reserves, and discussion of new technology and uses, with bibliography. A. BUTTS

Potash. J. W. TURRENTINE. *Mineral Ind.* 35, 550-62(1926) - A review of the industry in the U. S. and other countries. A. BUTTS

Talc and soapstone. P. A. MCGURK. *Mineral Ind.* 35, 642-9(1926).—A review of technical developments and production. A. BUTTS

Fuller's earth. HERMAN GUNTER. *Mineral Ind.* 35, 252-3(1926).—Gives statistics of output and trade. A. BUTTS

Fuller's earth in 1926. JEFFERSON MIDDLETON. *Bur. Mines, Mineral Resources of U. S. 1926*, Part II, 9-12(preprint No. 2, published July 18, 1927). E. H.

Graphite. A. H. REDFIELD. *Mineral Ind.* 35, 323-34(1926).—The industry in the U. S. and other countries is discussed, with statistics. A. BUTTS

Monazite. ANON. *Mineral Ind.* 35, 471-3(1926).—The monazite industry is reviewed, including Th and Ce. A. BUTTS

Magnesite. HUGH M. HENTON. *Mineral Ind.* 35, 434-43(1926).—Varieties and production are covered, as well as Mg salts and Mg metal, with a bibliography. A. BUTTS

Mica. W. M. MYERS. *Mineral Ind.* 35, 461-7(1926).—Varieties and uses are discussed and data given on production. A. BUTTS

Asbestos. OLIVER BOWLES. *Mineral Ind.* 35, 66-74(1926).—Varieties and uses, market and world production are discussed. A. BUTTS

Asbestos. F. J. DUNK. *India Rubber J.* 74, 252(1927).—Crit. comments on an article by Longley (cf. *C. A.* 21, 2536); several errors are pointed out. C. C. DAVIS

Micro-asbestos. HEINRICH ROSENBERG. *Chem.-Ztg.* 51, 548-9(1927); cf. *C. A.* 21, 181, 510, 1692. - Asbestos from Burgenland (Austria) is a homogeneous, greenish white, fine powder of micro-fiber structure, SiO_2 51.1 to 49.9%, Al_2O_3 5.3 to 4.7%, CaO 14.0 to 15.2%, MgO 21.9 to 23.8%, moisture (120°) 0.3 to 0.5%, volatile (1000°) 3.1 to 2.5%. For all purposes, except spinning, it is equiv. to fibrous asbestos. B. J. C. VAN DER HOEVEN

Carbon black produced from natural gas in 1926. C. R. HOPKINS. *Bur. Mines, Mineral Resources of U. S. 1926*, Part II, 13-6(preprint No. 3, published July 20, 1927) E. H.

duced by burning P or gas mixts. contg. P and directing the P flame into an absorption tower.

Ammonia from carbides. L. TOCCO and M. LANDI. Brit. 262,090, Nov. 27, 1925. Ba carbide or other carbide is treated with N to obtain a cyanide and the cyanide is then treated with H to produce NH_3 and regenerate the carbide.

Cyanides. P. COMMENT and D. HATT. Can. 272,316, July 12, 1927. Cyanides of the alkali metals are made by mixing CaCN_2 , CaC_2 and Na_2CO_3 in the proportions given by the equations: $\text{CaCN}_2 + 2\text{CaC}_2 + \text{Na}_2\text{CO}_3 \longrightarrow \text{Ca}(\text{CN})_2 + 2\text{CaO} + \text{Na}_2\text{O} + 4\text{C}$; $\text{Ca}(\text{CN})_2 + 2\text{CaO} + \text{Na}_2\text{O} + 4\text{C} \longrightarrow 2\text{NaCN} + 3\text{CaO} + 4\text{C}$. The mixt. is heated in such manner that the quant. yield of cyanide will be approx. attained.

Alkali cyanides. I. G. FARBENINDUSTRIE AKT.-GES. Brit. 262,456, Dec. 4, 1925. Combined S is removed from solns. of alkali cyanides by treatment with Bi compds. such as a Bi salt or hydroxide.

Alkaline earth compound. II. HAILL. Can. 272,210, July 5, 1927. New complex alkali and alk. earth compds. of mercaptocarboxylic acids are produced by treating a mercaptocarboxylic acid with an O_2 compd. of tervalent Sb and neutralizing with an alkali or alk. earth.

Cyanogen compounds. R. W. POINDEXTER, JR. and W. E. OLBERG. U. S. 1,642,694, Sept. 20. In forming cyanogen compds. of alkali-forming metals, their carbides are treated with anhyd. HCN , and with a relatively small proportion of a promoter such as NH_4Br , PhCOOH , NH_4CNS , CaBr_2 , NH_4I , ZnCl_2 or ZnBr_2 which is free from H_2O and from H_2O -forming components.

Ammonium carbonate. RIENANIA-KUNHEIM VEREIN CHEMISCHER FABRIKEN AKT.-GES. Brit. 262,408, Dec 7, 1925. The H_2O required for the production of solid $(\text{NH}_4)_2\text{CO}_3$ by the interaction of gaseous NH_3 , CO_2 and H_2O is supplied either continuously or intermittently in liquid form to the walls of the reaction chamber or to reaction surfaces within it. The H_2O may be introduced in the form of an aq. soln. of NH_3 or of $(\text{NH}_4)_2\text{CO}_3$ and the reaction may be carried out in a rotating vessel.

Ammonium carbonate. T. COXON. Can. 271,935, June 28, 1927. Solid compns. in which the NH_3 - CO_2 ratio is less than that of $\text{H}_2\text{NCO}_2\text{NH}_2$ are produced by bringing CO_2 into reaction contact with solid $\text{H}_2\text{NCO}_2\text{NH}_4$ material in the presence of H_2O and introducing NH_3 with the CO_2 , so that surplus H_2O is removed by formation of solid NH_4HCO_3 .

Ammonium sulfate. SOC. ANON. DES FOURN A COKE SEMET-SOLVAY & PIETTE. Brit. 262,320, March 22, 1926. Distn. gases after removal of their NH_3 content are freed from impurities such as H_2S , CO_2 and HCN by scrubbing with aq. NH_3 and the fouled liquor is directly treated with CaSO_4 to form $(\text{NH}_4)_2\text{SO}_4$.

Ammonium fluoride. J. W. PROCTOR. U. S. 1,642,788, Sept. 20. HF gas is brought into contact with a liquor contg. NH_4F until a soln. is obtained which, on subsequent addn. of NH_3 and cooling, will deposit crystals of NH_4F and crystn. of the latter is then effected, the crystals are sepd. and the mother liquor is reused for continuing the process. An app. is described.

Fluorides. F. SANDER. U. S. 1,642,896, Sept. 20. Silicic acid, fluorspar and BaF_2 are heated with HCl , the difficultly sol. fluosilicate formed is filtered off, decompd. with aq. NH_3 , and the resulting soln. of NH_4F is filtered off.

Separation of oxy salts from alkali mixtures. H. HARRIS. Can. 271,497, June 14, 1927. Na oxy salts of Sn and As are sepd. from a soln. comprising NaOH , Sn and As, by bringing the soln. to such a concn. that the oxy salt of Sn is for the most part insol. in the soln. while hot, but the As remains sol. The insol. Sn is sepd. from the hot soln. and the remaining soln. is dild. to a concn. at which the As will sep. out when the soln. is cooled.

Sodium phosphate. II. HOWARD. U. S. 1,642,244, Sept. 13. A soln. contg. colored impurities (such as those occurring in a crude soln. of H_3PO_4 obtained by treating crude ground phosphate rock with H_2SO_4 and sepg. the soln. from the undissolved residue) and a Na phosphate or other O-contg. pentavalent P compds. is treated with Cl to effect decolorization.

Calcium nitrate. C. RYER and R. GRIESSBACH. Can. 273,331, Aug. 23, 1927. Solid $\text{Ca}(\text{NO}_3)_2$ is manufd. by spraying, by means of a current of air, a hot concd. soln. of $\text{Ca}(\text{NO}_3)_2$ contg. a small quantity of NH_4 salt.

Lead carbonate from lead chloride. S. C. SMITH. U. S. 1,643,261, Sept. 20. Pb chloride is suspended in an aq. soln. of NH_3 in excess of that equiv. to the chloride, and CO_2 is passed through the suspension.

Basic copper sulfate. H. HOFMAN. Can. 271,782, June 21, 1927. Basic Cu sulfate, suitable for the prepn. of ammoniacal CuO cellulose solns. in the artificial-silk

stretch-spinning process, is pptd. from a soln. of ammoniacal CuSO_4 by the addn. of H_2SO_4 .

Sodium sulfite and boric acid. H. BLUMENBERG, JR. U. S. 1,642,535, Sept. 13. A soln. of borax is treated with SO_2 until the reaction forming Na_2SO_3 and H_3BO_3 is complete as indicated by the formation of a cloudy ppt. of NaHSO_3 ; the pptd. H_3BO_3 is sepd. from the mixt. and the remaining mixt. is treated with SO_2 to form NaHSO_3 .

Potassium sulfate from sea water. E. NICCOLI. Brit. 261,991, May 13, 1926. In the production of K_2SO_4 from sea water as described in Brit. pat. 247,405 (C. A. 21, 630), the raw mixed salts are treated with a quantity of cold H_2O insufficient to give a total soln., so that Na salts and chlorides are removed, and the desired double sulfate remains as a residue. Any double sulfate which is dissolved is recovered by using the later washing waters for the raw salt repeatedly.

Decomposing insoluble minerals with boric acid. G. BERGE. U. S. 1,642,667, Sept. 20. Minerals such as feldspar are heated with H_3BO_3 to convert basic constituents such as K into borates and the latter are treated with dil. HNO_3 to form nitrates and free H_3BO_3 .

Aluminum oxide. B. T. HORSFIELD. Brit. 262,405, Dec. 4, 1925. Residual metallic oxide impurities are removed from the hollow globules of Al oxide, obtained by the process of Brit. pat. 248,360 (C. A. 21, 630), by leaching them, with or without preliminary crushing or grinding, with an acid reagent and then washing.

Iron oxide. H. C. STEWART. U. S. 1,642,975, Sept. 20. Dry copperas is delivered with a blast of air into a furnace within which it is incinerated.

Activated carbon. A. GODEL. Can. 272,729, July 26, 1927. Activated C is produced by heating carbonaceous material enclosed in a permeable vessel and applying externally an atm. contg. activating gases.

Active carbon. K. RUBE. Brit. 262,278, Dec. 22, 1925. Pulverulent active C is obtained at relatively low temps. by heating oils which are normally incapable of being cracked economically, such as gas tar from lignite, in pressure-resisting vessels to 350–500° so that part of the oil remains liquid during the reaction, and subsequently purifying the C, e. g., with hot H_2O . Powd. lignite and lignite oil may be used together as raw materials.

Regeneration of active carbon with chemicals. NAAMLIOOZE VENNOOTSCHAP ALGEMEENE NORIT MAATSCHAPPIJ. Dutch 16,750, Aug. 15, 1927. Active C is regenerated by treatment in 25% suspension with 1% HCl (or other acids) for $\frac{1}{2}$ hr. at 5 atm. The org. impurities are hydrolyzed.

Carbon black. L. SIMPSON. Can. 272,468, July 19, 1927. Carbon black is manufd. by mixing with pulverized albertite an inert preheated gas or air under pressure and partially burning the mixt. The resultant gases are passed through suitable screens to deposit the C.

Hydrogen. G. CLAUDE. Can. 271,785, June 21, 1927. A gaseous mixt. contg. H_2 is partially liquefied and the compressed residual H_2 thus obtained is washed with liquid N_2 which has been cooled to a temp. at least as low as -200° . The washed H_2 is then expanded.

Sulfur dioxide. METALLBANK UND METALLURGISCHE GES., AKT.-GES. Brit. 261,081, Nov. 25, 1925. Different gas streams carrying different quantities of SO_2 and possibly also of H_2O such as obtained in a single app. for roasting S-contg. materials are worked up separately for the manuf. of H_2SO_4 , sulfite soln., etc., by treatments suited to the diln. of the gas.

Drying sulfur dioxide. ALLGEMEINE GES. FÜR CHEMISCHE INDUSTRIE. Brit. 261,732, Nov. 19, 1925. Liquid SO_2 which has absorbed H_2O and been vaporized as in the process for refining hydrocarbons is dried by condensation and the liquid formed in the first stage and contg. all of the H_2O is sepd. from the remaining dry gas. The gas may be dried from the aq. condensate, and the condenser may be tapped at a suitable point or a preliminary and final condenser may be used.

Carbon disulfide. ZAHN & CO. BAU CHEMISCHER FABRIKEN GES. Brit. 261,990, May 12, 1926. In the continuous manuf. of CS_2 , S freed from impurities is combined with charcoal in a heated retort and CS_2 is formed and distd.; distillate is condensed in a cooler with sepn. of H_2S which is converted into S, and the CS_2 is led to a heated separator to remove the last traces of H_2S . App. is described for purifying the S by melting with external heating and drawing it off through a siphon device. Other features of the app. are also described in detail.

Composition for generating chlorine. D. A. PRITCHARD and J. H. HUBEL. Can. 273,085, Aug. 9, 1927. A mixt. for producing Cl_2 upon contact with moisture consists of dry $\text{Ca}(\text{ClO})_2$ and cryst. H_2BO_3 .

Recovery of volatilized catalysts. U. 262,475, Dec. 7, 1925. Catalysts volatilize materials such as active C, active SiO_2 and in the reaction app. The adsorbed catalyst is advantageously placed on each side of the intermittently reversed. The process is app. and H_2O vapors through a layer of C and is employed for recovery of Cu-Cl_2 in the Dea.

Silica gel. I. G. FARMENDUSTRIE. Silicic acid jelly, pptd. from an acid soln. such as Na_2CO_3 , NaOH , Na silicate, all for treating org. liquids.

Polishing and waterproofing composite and W. J. MCGIVERN. Brit. 269,571. A saponifiable material is mixed with finely divided with an aq. soln. of an org. colloidal.

Clarifying and decolorizing material MOORE. U. S. 1,642,871, Sept. 20, 1926. A clay with H_2O until in a plastic or flow state and the residue is then pptd. for use in clarifying and drying. The product is suitable for

Filtering membranes. J. DRECHSEL. filtrations and seps. are effected with an acetate, regenerated cellulose from vegetable. The membranes may be regenerated by impregnated with alumina, colloidal silica, Al₂O₃ or in multiple.

Filtering material. R. N. RIDGWAY. A mass is formed of an alkali metal carbonate soft coal; the mass is subjected to the heat at a temp. below 290° until the gas evolved is then subjected to temps. progressively increasing. N, dry steam is passed over the coked mass alkalis.

Filtering material. R. N. RIDGWAY. A soft coal is satd. with a soln. of an alkali and crystallized; the mass is air-dried at a temp. and the dried mass is heated in a reducing to a coking temp. in the presence of material with the volatile constituents of the coal, such as steam which will remove compds. of carbonate and the latter is leached out to suitable for use in filtering sugar solns. or

Bleaching pulp or other fibrous material 20. The fibers of pulp or other material are H_2O is added and the mixt. is discharged turbulence, and at the same time permitting

Composition for cleaning and polishing Sept. 20. Kerosene is mixed with a small

Stencil sheets. A. B. DICK CO. Inc. for use on duplicating machines are coated tempering agent such as Am or Bu tartrate or esters of glycerol, and a substance because the resistance of the compn. to being parted in making type-cut stencils, *e. g.*, chlorinated C₁₂ H₂₅ Cl₂ derivative, Zn stearate and oils such as castor, rape-seed, olive, almond or poppy oil.

Stencil sheet. W. H. KUEHL. U. S. 1,642,919, Sept. 20. Fine, unsized tissue paper is coated with material comprising a solid continuous phase of nitrocellulose compn. or other substance impervious to oil, a liquid oily phase such as a fatty oil dispersed in the continuous phase, and a preservative such as oil of camphor.

Stencil sheet coated with glue and zinc chloride. C. F. KUMML. U. S. 1,642,159, Sept. 13.

Artificial masses, lacquer, etc. C. NEPHEWER. Can. 272,404, July 19, 1927. A compn. of matter comprises a condensation product of urea and CH_2O and at least

1. FARMENDUSTRIE AKT.-Ges. Brit. 262,475, Dec. 7, 1925. Catalysts volatilize materials which may be suitably placed very active and adsorbent may be advantageously placed on each side of the intermittently reversed and the gas stream H_2O and to the passage of a mixt. of P through porous medium and may also be chloride.

U. S. 1,642,306, Feb. 19, 1926. A material is treated with a dil. soln. of alk. material NaOH or other base, to render it suitable

for use in the process. C. H. THOMPSON. Brit. 269,571. A resin or similar non-saponifiable material is melted and emulsified in water and alkali.

U. S. 1,642,871, Sept. 20, 1926. R. V. DAVIS and M. M. ALLEN. A composite type is agitated with an acid solution such as H_2SO_4 to remove the impurities, *e. g.*, by washing with water.

U. S. 1,642,871, Sept. 20, 1926. Various materials such as nitrocellulose, cellulose, gelatin, albumin, or gelatin or gelatin and cellulose may be impregnated with alumina and may be used singly or in combination.

U. S. 1,642,871, Sept. 20. A dry crystalline material is saturated finely divided alkali metal or other reducing agent and the residue is then subjected to the heat at a temp. below 290° until the gas evolved is then subjected to temps. progressively increasing. N, dry steam is passed over the coked mass alkalis.

U. S. 1,642,871, Sept. 20. A dry crystalline material is saturated finely divided alkali metal or other reducing agent and the residue is then subjected to the heat at a temp. below 290° until the gas evolved is then subjected to temps. progressively increasing. N, dry steam is passed over the coked mass alkalis.

U. S. 1,642,871, Sept. 20. A dry crystalline material is saturated finely divided alkali metal or other reducing agent and the residue is then subjected to the heat at a temp. below 290° until the gas evolved is then subjected to temps. progressively increasing. N, dry steam is passed over the coked mass alkalis.

U. S. 1,642,871, Sept. 20. A dry crystalline material is saturated finely divided alkali metal or other reducing agent and the residue is then subjected to the heat at a temp. below 290° until the gas evolved is then subjected to temps. progressively increasing. N, dry steam is passed over the coked mass alkalis.

one difficultly volatile substance capable of forming a solid soln. with the condensation product.

Heating composition. H. H. FAKER. Can. 273,386, Aug. 30, 1927. A compn. for chem. heaters comprises 70 parts comminuted metal, 7 parts CuSO_4 , 2 parts salt, $\frac{1}{10}$ part CaCl_2 , 1 part KClO_3 , and 1 part sawdust, all in commingled form and adapted to receive a quantity of H_2O to cause generation of heat.

Anti-freeze composition. R. S. WRIGHT. Can. 272,995, Aug. 9, 1927. An anti-freeze mixt. is comprised of 5 lbs. com. anhydrous CaCl_2 , $\frac{1}{2}$ oz. KHCO_3 , $\frac{1}{4}$ lb. mineral oil, 1 oz. $\text{K}_2\text{Cr}_2\text{O}_7$ and 9 lbs. H_2O . Cf. C. A. 21, 2174.

Fire-extinguishing device for use in oil tanks, etc. L. INGRAM. Brit. 262,697, Oct. 1, 1926.

Finish remover. C. ELLIS. Can. 272,162, July 5, 1927. A finish remover consists of a mineral wax, HCOAc , serving as a wax solvent, and Me_2CO , serving as a wax precipitant.

Ethyl acetate varnish remover. C. ELLIS. Can. 272,161, July 5, 1927. A non-aq. finish remover is composed of $\text{CH}_3\text{CO}_2\text{C}_2\text{H}_5$ as the sole solvent material, mineral wax and nitrocellulose.

Emulsion. G. J. MANSON. Can. 273,342, Aug. 23, 1927. Melted wax is mixed with a salt soln. and the salt soln. is pptd. under conditions to coat the wax particles with the ppt.

Emulsion. G. J. MANSON. Can. 273,343, Aug. 23, 1927. Wax is added to a soln. of Mg salt, which is then heated and agitated, and a silicate added.

Dolomitic article. H. S. LUKENS. Can. 271,804, June 21, 1927. Articles are made by carbonating MgO to convert it into a binder while accelerating the reaction by combining therewith moistened CaCO_3 .

Artificial mother of pearl. J. PAISSEAU. Brit. 261,771, Nov. 21, 1925. Sheets of plastic material contg. brilliant particles are distorted to modify their appearance. They may be superposed into a block and sliced or subjected to other mech. treatment. Brit. 261,772 specifies pressing or like treatment of similar material uniformly to distort the brilliant particles in parallel planes and produce sheets of uniform appearance.

Molding dentures of bakelite and similar materials. M. L. AXELROD. Brit. 261,410, Dec. 7, 1925. The exposed portions, or the whole denture, may be made of a mixt. of bakelite resin "SA225" and bakelite liquid resin "LA677" together with wood flour, lithopone, ZnO and a dye or pigment, e. g., toluidine toner. Various details of molding under pressure are described.

Molded composition. G. C. H. MILLER. Can. 271,394, June 7, 1927. A reaction mixt. comprising a fatty oil and S_2Cl_2 is introduced into a rigid and nondistensible mold and is then subjected to a high pressure sufficient to prevent sepn. of gaseous by-products until the desired reactions have progressed sufficiently to form a relatively rigid gel.

Diaphragm for telephone receivers. G. W. ELMEN. U. S. 1,642,778, Sept. 20, 1926. Diaphragms formed of sheet magnetic material such as an alloy of Fe 55 and Ni 45% are heated to about 1000° and slowly cooled, in order to develop max. permeability.

Marking articles with iodine and starch. J. D. GRANGE. U. S. 1,642,774, Sept. 20, 1926. Tracing cloth or other articles contg. starch are stamped with a soln. of I.

Thin acoustic diaphragms of pure aluminum. C. S. WICKES. Brit. 262,485, Dec. 7, 1925. Al is used contg. not more than 0.2% impurities.

Molded articles from scrap buckram, etc. J. SAMUELS, P. SLADE and J. F. WARD. Brit. 261,818, July 28, 1925. Buckram or other fabrics which may contain stiffening material, e. g., scrap obtained in hat-making, is used for making rods, sheets, blocks, plates or other forms under the action of heat and pressure and there may be added various substances such as glue, sawdust, sand, powd. glass, kieselsguhr or china clay. Floor- or wall coverings, heat-insulation, bowls, horns for loud speakers or other articles may be thus formed.

Discharging device for lime-kilns, etc. E. SOBEK. Brit. 262,125, Nov. 28, 1925.

Use of dichloroethylene as a refrigerating medium. W. H. CARRIER. U. S. 1,642,942, Sept. 20.

Use of an isomer of dichloroethylene as a refrigerating medium. W. H. CARRIER. U. S. 1,642,943, Sept. 20.

Refrigerant. J. PENTLAND. Can. 272,902, Aug. 2, 1927. A refrigerant is composed of SO_2 and pure ether mixed at a temp. of 20°F . and thoroughly mingled by agitation.

Animal and insect exterminator. E. DERREGBUS. Can. 272,775, Aug. 2, 1927.

A compn. is composed as follows: phenol 40, cresol 10, H_2O 20, alc. 15, pyridine 5 and $C_{10}H_8$ 10 g.

Adhesive. D. M. R. McCUBBIN. Brit. 262,313, May 5, 1926. An adhesive suitable for use on rubber and leather or for waterproofing fabrics is formed of gutta-percha, CCl_4 and C_6H_6 , with or without coloring substances such as Sb sulfide or lamp-black.

19—GLASS, CLAY PRODUCTS, REFRACTORIES AND ENAMELED METALS

G. E. BARTON, C. H. KERR

Fuel economy in glassworks practice. T. C. MOORSHEAD. *Glass Ind.* 8, 185-9 (1927).—The fuel consumption for the several processes are melting 60%, power 18%, annealing 16%, heating, etc., 6%. The chief factors of the melting process which det. its efficiency are dimensions of the furnace in proportion to the glass melted, nature of fuel, compn. and color of glass heated, age of the furnace and temp. of the external surroundings. H. F. K.

Importance of ductility as a working property of glass. R. E. SWAIN. *Glass Ind.* 8, 183-4 (1927). H. F. K.

Phonolite in the glass industry. HUGO KÜHL. *Sprechsaal* 59, 217-8; *Chem. Zentr.* 1926, II, 95.—Because of their high alkali and low Fe content, phonolites are useful raw materials, especially for the manuf. of bottles. C. C. DAVIS

Proposed specifications for glass-making sands. ANON. *Glass Ind.* 7, 37 (1926).—Specifications covering the general character, sizing and compn. of glass sands are given. The allowable impurities range from 0.1% Al_2O_3 , 0.02% Fe_2O_3 , 0.1% CaO plus MgO in first quality optical glass to 4.0% Al_2O_3 , 1.0% Fe_2O_3 , 0.5% CaO plus MgO in ninth quality amber glass. H. F. K.

Brilliancy and compositions of glassware. OSCAR KNAPP. *Glass Ind.* 8, 73-4 (1927).—The brilliancy of glass depends upon its index of refraction. The index can be calcd. from the compn. of the glass since the power of refraction of glass is an additive property of the refractive powers of the glass-forming oxides. The greatest variation between the calcd. and observed indices given is 0.005. H. F. K.

Some aspects of current plate-glass practice. I. E. ADAMS. *Glass Ind.* 8, 1-4 (1927). H. F. K.

Art glass of Leerdam. K. WASCH. *Glass Ind.* 8, 5-7 (1927). H. F. K.

Manufacture of light-diffusing glasses. J. B. KRAK. *Glass Ind.* 8, 109-10 (1927).—The discussion deals with several opacifiers, especially F compds. H. F. K.

The flow of glass in tanks. D. J. MCSWINEY. *Glass Ind.* 8, 155-7 (1927). H. F. K.

The deterioration and failure of glassworks refractories. B. M. PEARSON. *Glass Ind.* 8, 127-34, 190-3, 211-3 (1927).—Glassworks refractories must withstand high temp., chem. corrosion and some abrasion. Chem. compn., uniformity of compn. and texture, moderate porosity and freedom from fissures are given as the most important characteristics of refractories. The life of refractories can be prolonged by bringing the furnace carefully up to the working temps., heat soaking to aid the formation of sillimanite (mullite) at the surface, glazing with cullet before charging, avoiding large variations in the compn. of the glass, and by forced cooling of the walls. Convection currents in the batch and irregular corrosion of the tank walls are discussed. H. F. K.

Temperature gradients in the fabrication of machine-blown glassware. R. E. SWAIN. *Glass Ind.* 8, 8-10 (1927). H. F. K.

The importance of the heat accumulator for economic glass-melting operations. H. BARTH. *Sprechsaal* 59, 189-91; *Chem. Zentr.* 1926, II, 95.—A general description. C. C. DAVIS

Measurements of the index of refraction of glass at high temperatures. C. G. PETERS. Bur. of Standards, *Sci. Papers* No. 521 (1926).—In the interference method described a plate of glass is placed in contact with 2 interferometer mirrors in such a way that 2 adjacent sets of interference fringes are visible, one produced by light passing through the glass, the other by light passing through an equal space in vacuum. The change in index produced by increasing the temp. was detd. from the no. of fringe passing a reference point on the upper interferometer plate. Measurements were made on 9 glasses in the temp. region 20-700°. Glasses passed through a crit. expansion

region near 500° in which the expansion rate increased 2–7 times. The index decreased during this rapid expansion period. In each case the measured index was much larger than the index computed from the density relation $(\mu-1)/d = C$. The increase in index with temp. is probably due to the same cause as that which shifts the absorption band toward the longer wave-length region. H. F. K.

Tank-block endurance. S. R. SCHOLLS. *Glass Ind.* 8, 61–2(1927).—The advantages of *mullite* as a refractory material in glass operations are pointed out. H. F. K.

Theory of glass tank block corrosion. E. P. ARTHUR AND A. ERNEST MACGEE. *Glass Ind.* 7, 107–9(1926).—The importance of the vapor phase in the attack of alkalis upon tank blocks is stressed. H. F. K.

Tank-block problem solved at Corning. ANON. *Glass Ind.* 7, 257–61(1926).—Aluminous mixts. having about the compn. of *mullite* are fused in an elec. arc furnace above 1800° and cast into molds for the described blocks or other refractory shapes. Very slow cooling is necessary, 4 days being given a 200-lb. block. Their duration in practice is at least 3 times that of fireclay blocks. H. F. K.

Influence of character of fire in continuous tank practice. I. E. ADAMS. *Glass Ind.* 8, 25 6(1927). H. F. K.

Glass for condenser lenses. G. JAECKEL. *Glasindustrie* 34, 4(1926).—The constituents of glass which furnish heat-resisting properties are discussed. The compn. of Resista glass is given as SiO_2 65.6, Al_2O_3 2.24, B_2O_3 17.94, Fe_2O_3 0.10, PbO 0.28, ZnO 3.25, CaO 0.29, Na_2O 6.88, K_2O 0.51 and Sb_2O_3 2.91%. Good condenser lens glass should transmit a high proportion of the visible-light rays as well as the heat rays. H. F. K.

A new method of producing colored glass. ANON. *Glass Ind.* 7, 90–1(1926).—The patented process described claims a definite color change in colored glass by the addn. of certain alkali halides, especially notable in glasses of high B content. The effect of the halogen salt reverses that of B_2O_3 . H. F. K.

The manufacture of incandescent lamp bulbs by entirely mechanical methods. A. KARSTEN. *Z. Ver. deut. Ing.* 71, 1227–30(1927). H. H.

Automobile glasses. E. W. TILLOTSON. *Ind. Eng. Chem.* 19, 1099–1101(1927).—Processes for the manuf. of plate glass are discussed with particular reference to the requirements of the automobile industry. K. D. JACOB

Strain and the hot-water test for bottles. D. J. MCSWINEY. *Glass Ind.* 7, 261–3(1926).—The resistance to thermal shock is slightly higher for unannealed than annealed ware. Strongly and uniformly strained ware has about double the resistance to internal hydraulic pressure that it shows when well annealed. H. F. K.

An x-ray study of clays. I. B. STRUTINSKIĖ. *J. Russ. Phys.-Chem. Soc.* 58, 214–25(1926).—Specimens of clays of varying plasticity (Crimeanⁿ nacrite, Lozovikov kaolin, halloysite; 3 specimens of sukhar' of poor plasticity and 2 of plastic mulienka from Borovichi) were examd. by the Debye-Scherrer method in studying the relationship between size of the particles and plasticity. A water-cooled Hadding tube was used with a Cu anticathode, the current being 20 milliamps. at 50,000 v. A suitable Ni filter allowed only the K series to pass; time of exposure was 5 hrs. A system of discrete points was found to represent reflections from rather large quartz particles; another system of lines present in nacrite and in the Borovichi specimens must correspond to the clay particles proper; it disappears almost totally on heating above 550° . Some of the lines coincided with those measured by Rinne; 25 lines in all were present in the nacrite spectrogram, 8 in those of the Borovichi clays. Both sukhar' and mulienka were of similar chem. compn. The width of the lines measured with the aid of Koch's microphotometer did not increase with the angle of reflection of the x-rays, as it was observed by Scherrer for colloid Au and Ag. A comparatively small no. of particles of the order of 10^{-6} cm. is, probably present. No const. diff. in the width of lines was observed for sukhar' and mulienka. S. concludes that the lower plasticity of sukhar' may be due to occluded bodies of microscopic size; in the case of kaolin it may in some way be connected with the large no. of lines. The broadening of lines may not be indicative of the particle size, but caused by the variable parameter of the grating. The simplest molar cell of nacrite (kaolinite) belonging to the prismatic class of the monoclinic system is found to contain 2 mols. of $\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$ and described by $a = 5.09$, $b = 8.61$, $c = 7.92$, $\beta' = 64^{\circ} 35'$, $n = 2$. Samoilov's formula:

$\text{O}_2(\text{H})\text{O Al}(\text{OH})_2\text{Si}(\text{OH})_2\text{Al}(\text{OH})_2\text{O.O}$ is the most suitable one. B. C. S.

Factory design and equipment and manufacture of clay wares. IV. Reduction

of raw materials. T. W. GARVE. *The Clay Worker* 87, 534-41(1927).—G. discusses friability, crushing, grinding and pulverizing of raw materials for clay wares.

L. B. MILLER

The effect of the addition of sodium carbonate and sodium silicate on the casting properties of clay slip. F. E. BROWN AND CHI-FANG LAI. *Proc. Iowa Acad. Sci.* 33, 170(1926).—An abstract. The addn. of small amts. of Na_2CO_3 , or of Na_2SiO_3 , increases the plasticity of some clay slips and permits them to be cast when they contain a much smaller percentage of H_2O . This permits a much more rapid casting. Casts are made and removed from the mold in 20 min. The time for a cast increased for successive casts as the mold became filled with H_2O . After drying the original rate was possible. A mixt. of Na_2CO_3 and Na_2SiO_3 was found to be superior to either alone. The use of these salts did not injure either the mold or the quality of the pieces cast. As many as 100 pieces were cast in one mold.

W. G. GAESSLER

The influence of the oxide admixtures on the physical properties of silica brick. K. ENDELL AND R. HARR. *Ceramic Age* 9, 133-8(1927).—The true sp. gr. increases with addns. of CaO , Fe_2O_3 or clay. Microscopic examn. indicates that increasing clay content retards the conversion of quartz. Increasing CaO favors the formation of tridymite. Fe_2O_3 accelerates the formation of tridymite. Thermal expansion curves (to 1000°) show pronounced cristobalite effect at 230° and a quartz effect at 575° with mixts. rich in clay. Samples high in Fe_2O_3 , show strong tridymite and cristobalite effects between 100° and 300° , but no quartz effect at 575° . High CaO content scarcely affects porosity; high clay causes porosity to increase rapidly; high Fe_2O_3 decreases porosity. The softening temp. under 1 kg. per sq. cm. pressure is unchanged with increasing CaO up to 6%. Increasing Fe_2O_3 content up to 6% shows a reduction of only 20° . Increasing clay content, however, even in the presence of CaO or Fe_2O_3 , lowers the softening temp. very appreciably. Conclusions: (a) Clay in fired SiO_2 bricks should not exceed 1.5%; (b) CaO , up to 8%, has no effect upon the softening temp. under pressure and promotes the conversion of quartz into tridymite; (c) increasing Fe_2O_3 favors formation of tridymite and up to 4% has no influence upon the softening temp.

A. E. R. W.

Drying and baking of paving bricks. GUSTAVE COLIEZ. *Chaleur et industrie* 8, 449-55(1927) —Description of present-day practice in the United States.

A. PAPINEAU-COUTURE

The efflorescence of bricks and walls. W. DIETERICH. *Brit. Clayworker* 36, 134-5(1927).—The common causes of scumming and efflorescence are given. Scumming may be overcome by the addn. of BaCO_3 to the raw clay. Insol. salts of BaSO_4 and CaCO_3 are formed. A method for detg. the amt. of BaCO_3 required in any particular clay is given for use in plants having no chem. lab. Methods are also given for testing water and clay for sol. sulfates to det. the amt. of BaCO_3 required for use in plants having a small lab.

R. A. HEINDL

The relations between the composition and properties of enamel for steel plate. R. R. DANIELSON AND B. T. SWEELY. *Speersaal* 59, 80-1; *Chem. Zentr.* 1926, I, 2236.—Fourteef base and white-surface enamels were applied on plates and their resistance to shock, temp. changes and AcOH tested. Coeffs. of expansion and resistances to compression were first detd. Replacement of B_2O_3 by Na_2O increased the coeff. of expansion, the latter also being dependent upon the time of fusion and upon other influences. By replacing B_2O_3 step by step by Na_2O , the resistance to compression of base enamels diminished, that of surface enamels increased. Impact tests without bending are suitable for testing the adhesion of the enamel. The surface layer must be as thick as the base layer. Shock requirements for curved enamel parts serve as an indication of the toughness of the enamel. The resistance to temp. changes is increased when the coeff. of expansion of the base enamel is the same as, or greater than, that of the surface enamel. The resistance of the surface enamel to AcOH decreases directly with replacement of B_2O_3 by Na_2O .

C. C. DAVIS

The constitution of kaolin. Comment on the publication of G. A. Kall. O. KRAUSE. *Speersaal* 59, 186; *Chem. Zentr.* 1926, II, 96.—The proof given by Kall (cf. C. A. 20, 3339) is replete with errors.

C. C. DAVIS

"Stamped" porcelain or artificial resin. WALTER DEMUTH. *Speersaal* 59, 248-9; *Chem. Zentr.* 1926, II, 96.—"Stamped" porcelain should really be called "pressed" porcelain, since it is not stamped but pressed. It is replaced in elec. insulation work by artificial resin products, which fulfill more severe requirements.

C. C. DAVIS

The effect of reclaimed retort material and zinc oxide on the physical properties of retort mixts. E. S. WHEELER. *Bull. Am. Zinc Inst.* 10, No. 5-6, 97-107(1927).—A number of body mixts. for retorts were subjected to nine standard tests. Besides the

standard mix, which consisted of 50% fire clay and 50% flint clay, the mixes were made to contain increasing proportions of old retort material and in some cases ZnO. The addition of old retort material produces a lowering of the deformation value of a mixt. whereas the addition of ZnO seems to have little effect. Values for the water of plasticity and drying shrinkage were obtained. The mixts. contg. ZnO up to 7.5% showed the lowest drying shrinkage. A mixt. of 50% fire clay and 50% old retort material showed the highest shrinkage. A graph of the porosity of the mixts. at various temps. showed the standard mix to have a uniform and low porosity. Absorption values follow the trend of the porosity values almost exactly. Volume change on firing and transverse-strength measurements brought out the important fact that ZnO weakens the mixts. considerably at all temps. Mixts. contg. ZnO also make the poorest showing when subjected to the sag test. Those contg. over 25% old retort material show up poorest under the spalling test. The chem. analysis of each of the mixtures is included.

WILLIAM F. EHRET

Abrasives. V. L. EARDLEY-WILMOT. *Mineral Ind.* 35, 1-10 (1926).—A review, including natural and manufd. abrasives. A. BUTTS

Abrasives. I. Siliceous abrasives (EARDLEY-WILMOT) 8. The theory of fine grinding (MARTIN) 13. The importance of various materials in the gas industry (DUNKEL, PRAETORIUS) 21. Feldspar (WATTS) 18. Bricks, tiles, heat or electric-insulation (Brit. pat. 262,224) 20. Electric glass-making furnace (Brit. pat. 262,535) 4.

RIES, HEINRICH: *Clays, Their Occurrence, Properties and Uses, with Especial Reference to Those of the United States and Canada*. 3rd. ed., revised and enlarged. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. 613 pp. 1901.

Glass. M. PERNET. Can. 273,537, Aug. 30, 1927. In the manuf. of Na-Al-B-silicate glass, the Al is added to the glass compd. as Al sulfite, and the B as crystd. boron.

Heat-absorbing glass. W. C. TAYLOR. Can. 272,685, July 26, 1927. A heat-reflecting glass of low coeff. of expansion and of high absorption of the infra-red, has a high boron content, and contains potash, lithia, B₂O₃ and FeO.

Apparatus for drawing sheets of glass. A. E. SPINASSE. U. S. 1,643,184, Sept. 20.

Apparatus for shaping glassware. J. DAVIS. U. S. 1,642,722, Sept. 20.

Glass-receiving and -forming apparatus for making pressed glassware. D. L. HUBENDORF. U. S. 1,642,741, Sept. 20.

Apparatus for making pressed or blown glassware. T. C. STRIMER. U. S. 1,642,740, Sept. 13.

Receptacle and discharge device for molten glass. L. D. SOUBIER. U. S. 1,642,741, Sept. 20.

Apparatus for producing mold charges of molten glass. W. J. MILLER. U. S. 1,642,966 7 8, Sept. 20.

Apparatus for feeding charges of molten glass. HARTFORD-EMPIRE CO. Brit. 414,988, May 26, 1926.

Glass-pressing and -blowing apparatus. F. O'NEILL. U. S. 1,642,660, Sept. 13.

Making glass tubes or rods. P. SCHOONENBERG. U. S. 1,642,312, Sept. 13.

Apparatus for forming molded articles from glass. M. K. HOLMES. U. S. 1,642,740, Sept. 13.

Apparatus for forming glass bottles. H. HILLMANN. Brit. 262,038, Nov. 28, 1925.

Apparatus for making blown articles from glass. J. F. RULF. U. S. 1,642,828, Sept. 20.

Apparatus for drawing glass. A. A. DEBROCC. U. S. 1,643,152, Sept. 20.

Decorating glass. O. HOMMEL. U. S. 1,642,441, Sept. 13. Heat stored in glass during manuf. is utilized for fusing to the glass a granular powder made of stable glass.

Apparatus and heating system for annealing sheet glass. PITTSBURGH PLATE GLASS CO. Brit. 262,629, Feb. 16, 1926.

Apparatus for annealing glassware. O. SCHACKELFORD. U. S. 1,642,790, Sept. 20.

Ceramic insulators. F. SINGER. U. S. 1,642,754, Sept. 20. Ti compds. such as TiO₂ or Ca titanate are added to the ceramic mix and it is burned with an oxidizing flame and with a reducing flame to form both cryst. and amorphous Ti compds.

Refractory material. B. T. HORSFIELD. Brit. 262,403, Dec. 7, 1925. Hollow

globules of alumina or other fused refractory oxide are cemented together with a binder such as Na silicate, Na or Ca aluminate or clay, preferably contg. a considerable proportion of the same oxide as forms the globules.

Refractory materials. SCHREIDHAUER & GIESSENG AKT.-GES. Brit. 262,383, Dec. 4, 1925. Non-plastic refractory materials such as sillimanite, cyanite, chromite, alumina, carborundum, ZrO₂, magnesite or dolomite are used instead of chamotte in clay-bonded products as described in Brit. pat. 253,947 (C. A. 21, 2543).

Magnesite refractory. A. MARKS. Can. 272,533, July 19, 1927. Molded magnesite refractories are manufd. by mixing with the pulverized magnesitic refractory body material a suitable siccativ oil to form a plastic mass, the article then being molded and dried to hardness.

Refractory slabs. G. D. MORRIS. U. S. 1,642,886, Sept. 20. Kiln car platform slabs are formed with a body portion of fireclay and an edge portion of stronger refractory material such as carborundum.

Unburned refractory brick. G. K. SCHLOTTERER and R. H. YOUNGMAN. U. S. 1,643,181, Sept. 20. Bricks are made from dead-burned magnesite 90% or more and a binder of Na silicate 10% or less; the raw bricks are initially stored for a time in an atm. of high humidity.

Enameling metals. C. TOTOT-GIBARU. Brit. 262,159, June 16, 1925. To avoid employment of a first layer of clear ground enamel in employing leadless glazes for enameling metals by the dry method, an enamel is used contg. SiO₂, borax or borate-forming substances and at least 20% of ZnO and also contg. various other ingredients.

Tunnel kiln. DRESSLER TUNNEL OVENS, LTD., AND O. VERMORCKEN. Brit. 262,678, Aug. 19, 1926.

Tunnel kiln (heated by electric resistances) for glazing pottery or annealing metals. MORGAN CRUCIBLE CO., LTD., AND C. W. SPEIRS. Brit. 261,866, Sept. 9, 1925.

Waterproof abrasive fabric. F. J. CRUPI. U. S. 1,642,766, Sept. 20. Sandpaper or the like is formed with abrasive material held on 1 side with adhesive and with a coating on the other side which may be formed of a compn. of cellulose nitrate, oil and solvents.

20—CEMENT AND OTHER BUILDING MATERIALS

J. C. WITT

Special cements. J. DAUTREBANDE. *Rev. chim. ind.* 36, 151-6(1927); cf. C. A. 21, 2368.—A brief discussion of the manuf., compn. and properties of Fe cement, Ti cement, white cement, Keene's cement and refractory hydraulic cement.

A. PAPINEAU-COUTURE

The automatic furnace and its product. FRIEDERICH TIPPMANN. *Zement* 15, 370-3, 389-91, 404-7, 421-2(1926).—The deterioration of cement clinker during a 6 week period increased quite regularly with increasing fineness as did also the gain in CO₂ and H₂O. The most ideal separate consisted of well-burned pieces retained on the 1-in. screen. The general practices of clinker burning are discussed. H. F. K.

Reducing conditions and the color changes during the sintering of cement clinker. HANS KÜHL and W. ADAM. *Zement* 15, 456-8(1926).—In sintering clinker at least a part of the Fe₂O₃ present is uncombined because of the dissocn. of Ca ferrite at about 1400°. With quick cooling the Fe₂O₃ may remain free and tint the clinker according to the amt. present. Yellow to red tints may persist even under somewhat reducing conditions, if reduction is not carried to completion. H. F. K.

Plastic magnesia cements. L. C. STEWART. *Ind. Eng. Chem.* 19, 1139-43(1927).—A description of methods of tests, physical properties and uses of Sorel cements.

RAYMOND WILSON

Properties and testing of cement colors. C. R. PLATZMANN. *Rock Products* 30, No. 18, 107-9(1927).

RAYMOND WILSON

Action of calcium chloride on cements. M. ANSTETT. *Pit and Quarry* 14, No. 11, 51-2(1927).—A short review of the general results of other investigators of the effect of CaCl₂ upon the properties of concrete is given. The advantages to be gained by the use of CaCl₂ are stated.

L. B. MILLER

Lime. X. The loss in weight of limestone as a function of time and temperature of burning. H. K. LINZELL, M. E. HOLMES and J. R. WITHROW. *Trans. Am. Inst. Chem. Eng.* 18, 249-81(1926).—The results of an investigation indicate the following: (1) There is a min. temp. below which it is impossible to burn limestone, which is lower

for Mg limestones than for Ca limestones. The min. burning temp. (820° under conditions of the expts.) is a function of the concn. or partial pressure of CO present. There is a max. % loss of wt. on burning which varies with the chem. compn. of the stone. When maintained at 820° , the loss of wt. is directly proportional to the temp. and to the time of burning. The rate at which a limestone loses wt. on burning at any given temp. is a function of its chem. compn. The influence of time and temp. upon the completeness of burning on 9 limestones was detd. on a lab. scale. Exptl. data are tabulated, the general procedure is described, and the data and curves are discussed. The possible applications of the results obtained to com. lime burning are: (1) the elimination of the effects of the CO evolved by the use of air preheated by contact with the hot burned lime; (2) the manner in which the burning progresses from the heating zone to the center suggests that securing a means of spreading the heating zone further into the body of the charge might decrease the chances of having an unburned core and lessen overburning in the heating zone; (3) the application of these principles might permit the use of larger kilns and at the same time avoid the occurrence of unburned cores. Discussion brought out the accelerative effect of very small proportions of carbonate on the time of set of lime. The reason for this is yet unexplained.

W. H. BOYNTON

Report of the stone-preservation committee. ASTON WEBB, *et al.* *Dept. Sci. Ind. Research* (Brit.) 1927, 33 pp.—Decay of stone is chiefly due to soln. by H_2CO_3 of one or more of its constituents and mechanical removal of loosened but undissolved material. In city areas H_2SO_4 in the air causes the deposition of gypsum, resulting in surface scaling and internal stresses. The continuity and character of the porosity, whether intergranular or intercryst. (macro- or micro-porosity), appears to be important in detg. resistance to weather. A new method was developed for the prepn. of thin sections of weathered or soft stones for petrographic examn., consisting of impregnation *in vacuo* with liquid phenol resins and hardening of the resin under pressure in the pores of the stone. Exposure tests of representative stones with various preservative treatments have been started. Investigation of bacterial effect has revealed one species capable of luxuriant growth in an artificial medium extremely poor in org. food material.

RAYMOND WILSON

Highway construction. C. M. UPHAM. *Ind. Eng. Chem.* 19, 1121-2 (1927).

RAYMOND WILSON

Differentiation between seasoned wood and green wood. G. FRON. *Ann. fals.* 20, 386-91 (1927); cf. Lyon, F., and Fournier, C. A. 21, 1877.—The tests described were carried out on oven-dried wood. Kiln-seasoned wood gives practically the same results as green wood, so that the method can differentiate between kiln-dried and naturally seasoned wood. Wood aged by G. Lyon's process (treating with ozonized air with variations in pressure of the same order as variations in atm. pressure) gives the same results as naturally seasoned wood, showing that the process effects the same change in 1-2 months as are produced naturally in the course of several years.

A. P.-C.

The nature of decay in wood. B. O. LONGYEAR. *Colorado Agr. Expt. Sta., Bull.* 307, 58 pp. (1926).—The progressive loss of wt. during decay in wood may be used as a measure of the rate and extent of decay. A comparatively simple method is described whereby various cited relations affecting the rate of decay may be investigated.

E. F. SNYDER

Determination of Mg in portland cements (KALLAUNER, *et al.*) 7. Gypsum (WILDER) 18. Geology of the country around Ipswich, England [deposits for making cement and bricks] (BOSWELL) 8. Emulsions of bitumens, oils, rubber, etc. (Brit. pat. 262,724) 22.

Cement. T. RIGBY. *Brit.* 261,814, July 24, 1925. In making cement by the wet method in a rotary kiln, the dispersed slurry is caused to fill a substantial portion of the kiln and drying is so controlled that the deposited material, though still moist, is not sufficiently so to agglomerate into large masses. Various details of kiln construction and operation are specified.

Cement. E. C. ECKEL. *Can.* 271,852, June 28, 1927. A mixt. of materials contg. alumina, Fe, silica and CaO is fused in the presence of sufficient free C to form com. ferro-silicon and cement slag. Cf. C. A. 20, 272.

Low-lime high-alumina cements. H. S. SPACKMAN. U. S. 1,643,136, Sept. 20. A rotary kiln is used for fusing lime and aluminous materials in such proportions that the lime is present in substantially the quantity required to combine in a monocalcic ratio with the acid-acting components. The length of the kiln used does not exceed 10 times its internal diam.

Low-lime high-alumina cements. H. S. SPACKMAN. U. S. 1,643,137, Sept. 20. A charge of aluminous material such as bauxite and a base, *e. g.*, lime, is heated in an atm. adapted to prevent reduction of the Fe present, and the resulting slag is then cooled and pulverized.

Portland cement. C. PONTOPPIDAN. Can. 272,001, June 28, 1927. In making portland cement with an admix. of gypsum, the gypsum is not allowed to reach a temp. above 125°. Cf. C. A. 21, 3441.

Cements and mortars. C. SCHNEIDER. Brit. 262,294, Jan. 28, 1926. A colloid such as gelatinous silicic acid is added to salts such as CaCl_2 used to accelerate setting of cements or mortars or to activate substances such as slags having latent hydraulic properties, to render them resistant when stored. Oxides such as lime and retarding agents such as CaSO_4 may be added also.

Mortars. J. H. DITTER. Brit. 262,232, Oct. 30, 1925. Mg compds. such as asbestos, talc, magnesite or dolomite (but preferably Mg fluosilicate or other compds. comprising Mg and F) and an alkali silicate in colloidal form are added to mortar compns. H_2O -repelling substances or other materials also may be added. The production of the colloid is promoted by addn. of milk of lime or other alk. substances and the colloidal condition is maintained by adding CCl_4 .

Cement paint. S. B. NEWBERRY. Can. 272,549, July 19, 1927. A cement paint consists of portland cement incorporated with 0.1–1.0% of its wt. of a water-sol. Al salt and 1–10% of its wt. of an alk. earth metal chloride, and mixed with H_2O for use.

Porous concrete. E. I. LINDMAN. Brit. 262,394, Dec. 5, 1925. A porous clay clinker is used as an aggregate in concretes which are rendered porous by generation of gas within them. Cf. C. A. 20, 3793.

Plaster. G. H. WHITTLE. Brit. 262,195, Sept. 8, 1925. A plaster for coating walls or ceilings, making dental molds, etc., comprises powd. quickly calcined gypsum, powd. rock alum and powd. rock niter; Na_2CO_3 and coloring substances also may be added. The alum and niter are preferably used in the proportions of 19 and 16 lbs., resp., per ton of dry calcined gypsum.

Flooring covering. H. H. DUKE. U. S. 1,642,845, Sept. 20. A layer comprising granulated cork 4 and rubber 1 part, together with vulcanizing ingredients, is united and vulcanized together with another layer of soft rubber and coloring substances.

Paving blocks comprising rubber. H. H. DUKE. U. S. 1,642,846, Sept. 20. A rubber-tread surface is vulcanized to blocks formed mainly of a compn. comprising rubber 1 and granular cork 4 parts.

Compositions for floors. H. SCHUSTER. Brit. 262,315, March 23, 1926. Structural features are specified of tiles which may be made of sawdust, MgO and MgCl_2 , laid on a concrete foundation and covered with a layer of magnesite and sawdust compn.

Sectional rubber pavement. A. F. MASURY and A. H. LEHERT. U. S. 1,643,024, Sept. 20. Rubber blocks are held under compression by a retaining covering which may be formed of sheet metal.

Bricks, tiles, heat- or electric-insulation, etc. F. MULLIGAN. Brit. 262,224, Oct. 14, 1925. A gypsum cement such as described in Brit. pat. 238,949 (C. A. 20, 2058) is used with sand or other aggregate and coloring matter; portland cement and asbestos may be added.

Artificial stone. P. MEYER. Can. 272,199, July 5, 1927. Artificial stones are manifold by mixing stony raw material with a phenolic compd. and an aldehyde, adding a catalytically acting substance, molding the mixt. by pressure and heating the molded body.

Volcanic stone castings. C. KRUGER. Brit. 262,413, Dec. 2, 1925. In producing castings from volcanic rocks or slags, the temp. is so regulated that the more infusible cryst. particles do not melt but serve as inoculation centers for the recrystn. of the remaining material.

Wood preservation. L. P. CURTIN. Can. 272,773, Aug. 2, 1927. Wood is preserved by impregnating it with an aq. soln. contg. water-sol. components capable of reacting on exposure to the atm., and with progressive increase in basicity to deposit within the body of the wood, a Cu-As compd. of low soly. and high toxicity. Cf. C. A. 21, 1339.

Tank and dry kiln for preserving and drying wood. G. E. RICE and C. L. SIMMONS. U. S. 1,643,174, Sept. 20.

21—FUELS, GAS, TAR AND COKE

A. C. FIELDNER

A French national liquid fuel policy. G. KIMPFLEIN. *Chaleur et industrie* 8, 437-48(1927).—Discussion of measures by which France could become self-sustaining as regards her supply of liquid fuels for internal combustion and explosion engines.

A. PAPINEAU-COUTURE

Liquid fuels in their relations to motors. M. DUMANOIS. *Ann. office nat. comb. liquides* 2, 9-20(1927).—An address.

A. PAPINEAU-COUTURE

Manufacture of motor benzene. E. L. HALL. *Chem. Met Eng.* 33, 289-92(1926).—The system of recovery and purification of benzene employed by the Portland Gas Light & Coke Co., Portland, Ore., is described and illustrated. Factors affecting scrubber size are: velocity of gas flow, time of contact and amt. of wash oil circulated. With tower scrubbers it is usually impossible to obtain a satn. of the light oil in the absorption oil of more than $3\frac{1}{2}$ -4% and still maintain a high recovery efficiency. The efficiency of absorption is dependent on the vapor pressure of the benzene in the gas and in the absorption oil. By maintaining the benzene content of the wash oil below 0.5% the recovery efficiency is 95-97%. The principal requirements of a good absorption oil are: (1) low sp. heat; (2) low viscosity at all temps.; (3) olefine content not over

(4) high initial b. p. (not below 204°); (5) low mol. wt. W. H. BOYNTON

Motor fuels. J. B. HILL. *Ind. Eng. Chem.* 19, 1114-5(1927).—An address.

W. F. FARAGHER

Ignition temperature of domestic fuels. RYUJI KADA. *J. Fuel Soc. Japan* 6, 619-31(1927).—The ignition temp. of the most common domestic fuels used in Japan which included various samples of charcoal, peat, lignite, coke, anthracite and briquet was detd. The new briquet prepd. by K. had many advantages over charcoal.

NAO UYEI

Utilization of marine animal and fish oils (as fuels) in motors. GEORGES LUMET and HENRI MARCLET. *Compt rend* 185, 418-20(1927); cf. *C. A.* 21, 1890-1.—Calorific values, flash- and burning-pts., d., Engler viscosities and results of bench tests in 4- and 10 h. p. Diesel-Hindl motors are tabulated for oils of *Centhorinus maximus* (Gunner), *Centrophorus granulatus* (Mull. and Henl.), *Hexanthus griseus* (Rafin) and *Dorosoma* (Bloch.), fat of Trey-Pra from Kompong-Chuang, Trey-Reach from Kompong-Chuang, Trey-Reach from Prey-Veng and Trey-Lenh from Kompong-Thon, squalene hydrocarbons extd. from centrophorus oils and gas oil (for comparison). The power developed by the motors with the fish oils was practically the same as with the gas oil. The sp. consumption was slightly higher with the fish oils and approx. inversely proportional to their calorific value. Operation of the motors was more flexible with the fish oils (as has been observed with vegetable oils), and the shock of the explosion was not so sharp. The only difficulty encountered with the fish oils was due to their relatively high viscosity, and could be eliminated by preliminary heating of the oil in a closed vessel (on account of the disagreeable odor); preliminary filtration of the fish oils also necessary. The fish oils are perfectly and efficiently utilized, the exhaust being colorless and practically odorless.

A. PAPINEAU-COUTURE

Fuel value of certain Mauritius woods. G. CRAIG. *Rev. agr. Maurice* 4, 77-82(1927).—Moisture, ash, volatile matter, fixed C and fuel value were detd. for 14 different kinds of native woods. The fixed C content, which is important in the production of charcoal, was highest for *Leucocna glauca* (13.8%), *Eucalyptus robusta* (12.62%), and *Psidium cattleianum* (12.78%). The fuel values, on the basis of 10% moisture in the wood, ranged from 3938 cal. (*Albizia lebbek*) to 4419 cal. (*Casuarina equisetifolia*).

F. W. ZERBAN

Studies on peat. II. Distillation under reduced pressure of certain constituents of peat. JOSEPH REILLY and JOAN SULLIVAN. *Sci. Proc. Roy. Dublin Soc.* 18, 383-8(1927); cf. *C. A.* 21, 2781.—The peat was first fractionated into its leading constituents, each of which was rapidly distd. under reduced pressure and the products of distn. were collected in 2 receivers—one kept at 60°, and the other immersed in a freezing mixt. of ice and salt. Distillate collected at 60°, distillate collected at 0°, and gas were the crude products in each case. Humic acid and the HCl ext. of peat gave very little tar. Humic acid gave the highest percentage of coke and the alc.-sol. portions of humus the lowest. Humic acid and insol. humin gave the largest vols. of gas. The quantity of each distillate and gas is shown in tables.

L. W. RIGGS

Nitrogen as a catalyst in the determination of sulfur in coal by the bomb-washing method. J. P. KOHOUT. *Ind. Eng. Chem.* 19, 1065-6(1927).—Working on the as-

assumption that oxides of N formed in the O-bomb act catalytically in the oxidation of the S in the coal, K. tested 35 bituminous, 4 semi-bituminous coals and 1 coke for their S content by the usual O-bomb method and by adding N sufficient to raise it to 10-15% of the atm. of the bomb. Details of procedure and data on the 40 samples tested are given. In most cases the % S obtained was slightly higher when the N-O mixt. was used; especially was this true with the high-S coals. This modification brings results for % S in coal by the bomb-washing method into closer agreement with detns. for S by the Eschka and Na_2O_2 methods as recommended by the A. S. T. M. (cf. C. A. 21, 2370). W. W. HODGE

Total carbon in coal. G. B. WATKINS. *Ind. Eng. Chem.* 19, 1052-4(1927).—The methods available for detg. the total C in coal and in combustible org. compds. are outlined. Detailed descriptions with sketches of app. used, manipulations employed, and calcus. involved are given for detg. total C by measurement of the vol. of the gas and analysis for its CO_2 content which is formed when the material is burned in an O-bomb calorimeter. After taking the readings required for the B. t. u. test less than $\frac{1}{2}$ hr. more time is needed to det the total C by this method. Comparative data are given for 5 coals, BzOH and sucrose. Total C in the coals detd. by this method checked the Bureau of Mines values within 0.1%. W. W. HODGE

Coal in relation to its parent material and to the degrees of transformation. K. PATTEISKII AND F. PERVATEL. *Glückauf* 61, 1585-94(1925); *Chem. Zentr.* 1926, II, 180.—A discussion of the classification of various types of coal according to their origin, the coals including: (1) anthracites, which are subdivided into vitrain and clarain; (2) cannel coals (durain); (3) fibrous coals (fusain) and (4) clayey trench coal ("Schramkohle"). Coal seams in which anthracite predominates throughout contain as a rule a mixt. of these types. Each of these types of coal underwent a geochem. transformation, which included the progressive formation of the coal, the formation of bitumen or conversion to anthracite. The extent of the transformation of the parent material to coal was influenced by temp. and pressure. Coals from various kinds of parent materials are compared with one another with respect to the degree of their transformation, including gas-flame, gas, fat and lean coals and anthracite, and their technical utilization is discussed. C. C. DAVIS

Enhancing the value of coal. O. NAUSS. *Gas u. Wasserfach.* 70, 832-4(1927).—A review of the use of coal as a raw material for the production of low-temp. coke, tar, oils and gas of high calorific value, as well as the hydrogenation of coal (Bergius process) and the Fischer synthesis of hydrocarbons. R. W. RYAN

Carbon ratio. MURRAY STUART. *J. Inst. Petroleum Tech.* 13, 308-10(1927).—The "carbon ratio" has frequently been used in recent literature to designate the ratio of C to H in coal. White (C. A. 9, 1291) introduced this expression; by it he meant the % of fixed C in coal if moisture and ash are neglected. This is very different from the ratio C:H. BRIAN MEAD

Observations on the so-called "algae" of boghead coals. HELLMERS AND POTONIC. *Z. angew. Chem.* 40, 895-7(1927).—A discussion of the morphology, reactions and origins of certain substances obtained in the maceration of boghead coals with Schulze's mixt. H. L. OLIN

Pulverized coal. P. R. MIDDLETON. *Commonwealth Eng.* 15, 5-10(1927).—Advantages are pointed out for pulverized coal, resulting in fuel economy of 20-50%. The unit and multiple systems are briefly outlined. Drying, pulverizing, transporting and burning methods are described. Pulverized coal seems best adapted for firing boilers of a water-tube type. Units of a multiple system are illus. W. H. BOYNTON

Utilization of North Carolina coals. F. C. VILBRANDT. *J. Elisha Mitchell Sci. Soc.* 42, 126-30(1926).—Deep-river coal is high grade for by-product use but gives too much smoke to be desirable for steam purposes. Low-temp. distn. produces large quantities of heavy hydrocarbons. The initial and secondary decompn. points of this coal are 540° and 700° , resp. Eight samples from different parts of this field were analyzed and one of them was subjected to coking tests at various temps. The better samples contained volatile matter 27.80-37.80, fixed carbon 51.95-66.00, ash 5.37-9.03, S 0.22-2.76% and yielded 13,450-14,330 B. t. u. A. L. MEHRING

Coal mining in China. MANJI YOSHIMURA. *J. Fuel Soc. Japan* 6, 659-69(1927).—The name and distribution of mines, the amt. of production and the properties of coal are described in detail, numerous data being used. NAO UYI

Modern coal and ore washing processes. GEORGES RANWEZ. *Technique moderne* 19, 522-8(1927).—Description of the various types of app. used. A. P.-C.

Coal and coke. R. W. MORRIS. *Mineral Ind.* 35, 112-49(1926).—A review of the industry in the U. S. and foreign countries. A. BUTTS

Report of Committee D-5 on coal and coke. A. C. FIELDNER AND H. C. PORTER, *et al.* *Proc. Am. Soc. Testing Materials* (preprint), No. 6, 45 pp.(1927).—A report presented at the 30th Annual Meeting in June, 1927. It embraces proposed (1) standard, (2) definitions of terms relating to coal and coke, (3) tentative methods for detn. of S in coal and coke, (4) revised methods of sampling and analysis. Of special interest is the method for detg. S in the bomb washings. Cf. C. A. 21, 2370. H. L. OLIN

The study of cenospheres. V. The carbonization of particles of coal. F. S. SINNATT, A. McCULLOCH AND H. E. NEWALL. *J. Spc. Chem. Ind.* 46, 331-5T (1927).—Previous work on the study of cenospheres is reviewed. Expts. are described of coking particles of coal in atm. of coal gas, H₂ steam, coal gas at a reduced pressure, and coal mixed with different per cents of electrode C, briquetted and then pulverized. A description and dimensioned drawings of the app. used and 8 photomicrographs of the untreated and treated particles are given. Reduction of pressure and an atm. of steam inhibit the formation of the typical "cenosphere" window and lattice structure, but atm. of N₂, coal gas and H₂ do not appear to have this inhibiting effect. In mixts. made with coal and increasing amts. of electrode C the cenospheres become reduced in size and modified in structure. Pulverization and briquetting appear to cause the formation of small cenospheres within a larger particle, the larger particle having the appearance of a "blackberry." Each surface protuberance appears to be an individual cenosphere, either fully formed or in the process of formation. The study of cenospheres produced from mixts. of coking coals with inert material may be of value in problems of blending mixts. of coals in coke manuf. W. W. HODGE

Cleaning of natural gas. H. B. MILAM. *Am. Gas J.* 126, 608-11(1927).—History and description of the development of a scrubber for removing dust by bubbling gas through mineral-seal oil. The oil scrubber removes 99.6% of the dust and a thirty-inch unit cleans nine million cu. ft. per day. R. A. BAXTER

The combustion of methane to formaldehyde. OTTO ROELEN. *Abhandl. Kenntnis Kohle* 7, 111-6(1925); *Chem. Zentr.* 1926, II, 1398.—A compilation of the literature. C. C. DAVIS

Gas producers and water-gas generators with built-in boilers. C. MARISCHKA. *Gas u. Wasserfach* 70, 826-32, 849-52, 884-8(1927).—The producer is water-jacketed and provided with water tubes in an outside jacket through which the hot gases are circulated. The internal diam. of the producer is 6½ ft. and produced 1.32 kg. steam per kg. coke gasified (at 90-lb gage). Revolving grates are used as well as an inner replaceable lining on the inside of the shell opposite the grate. Combination water-gas generator-boilers are in use and are economical in space and cost, in small sizes. It is suggested that these combinations may have general applications in industrial plants, especially where cheap water gas is required. Cf. C. A. 21, 3264. R. W. R.

Some experiences in the operation of waterless gas holders. J. G. O'KEEFE. *Proc. Am. Gas Assoc.* 1926, 1244-9.—Comments are made on the operation of the new improved waterless gas holder of 15,000,000 cu. ft. capacity at Harrison, N. J. It is maintained that these holders are sound in principle and design. H. L. OLIN

The measurement of large volumes of gas. M. E. BENESH. *Proc. Am. Gas Assoc.* 1926, 1273-6.—A preliminary report. Air from a large holder was measured in series by (1) orifice, (2) rotary displacement, (3) wet drum, (4) venturi-tube, (5) Thomas Electric and (6) Bureau of Standards nozzles. The data obtained are being analyzed for a future report. H. L. OLIN

Dehydration of manufactured gas. F. W. SPERR, JR. *Proc. Am. Gas Assoc.* 1926, 1250-73. See C. A. 21, 641, 1535. H. L. OLIN

The importance of various materials in the gas industry. R. DÜNKEL AND E. PRÄTORIUS. *Gas u. Wasserfach* 70, 822-6(1927).—The characteristics of a good oven refractory must be resistance to the highest operating temp., const. vol., insensitiveness to temp. fluctuations, good heat cond., and resistance to chem. attack. Clay, quartz and silica refractories are evaluated on the basis of these properties. Corrosion of metals is discussed. In many cases metals can be replaced by ceramic materials or concrete, especially pipes made of a 4 to 1 cement-asbestos fiber mixt. Sheet metals and their protection as well as safe-boiler construction are also discussed. R. W. R.

Improvements in the control of the heating value (of gas). KRANZ. *Gas u. Wasserfach* 70, 801-8(1927).—A description of the latest Junkers automatic calorimeter and of a hand calorimeter with automatic water cut-off. R. W. RYAN

Requirements as to the uniformity of gas in a single distribution district. KARL FUNKE. *Gas u. Wasserfach* 70, 797-801(1927).—Statistics are given as to the av. values and max. variations of heating value, d., inerts, O, H₂S, NH₃ and naphthalene in a large no. of German cities. The following specifications are suggested. Heating value may

vary not over $1\frac{1}{2}\%$ (as measured); d. not over 0.015 (measured) with reference to 0° and 760 mm.; the quotient (heating value) divided by the square root of the d. should not vary over 1.5%; inerts less than 12%; O_2 never over 0.5%; H_2S in extreme cases not over 2g./100 cu. m., NH_3 0.5 g. per 100 cu. m. and naphthalene not over 5g./p per 100 cu. m. (p is pressure in atm.). R. W. RYAN

Michell crankless gas engines and boosters. ANON. *Gas J.* 179, 385-7(1927).—The Michell crankless gas engine, as developed in Australia, operates on the 4-cycle system with a volumetric efficiency of 90% and a mech. efficiency of 87%. It may be run at 250 to 800 r. p. m. The reciprocating motion of the pistons is transformed to circular motion by means of a "slant" or "tilt." Engines of 280 h. p. (12 cylinders) have been built. They operate on coal-, water-, producer-, coke-oven- or blast-furnace gas. R. W. RYAN

Gas in industry. L. J. TERNEDEN. *Het Gas* 47, 432-4(1927).—Tabulated statistics are given on gas consumption by industries in the Netherlands; the total 1926 figure was 8.8 million cu. m. B. J. C. VAN DER HOEVEN

Leading away products of combustion from gas fires. P. SPALECK. *Gas World* 87, 124-5(1927).—A study of chimney design and operation was made. From the viewpoint of the relation between draft and resistance and the time taken in warming up the chimney the mason-work chimney is inferior to the 2-in. diam. sheet metal pipe R. W. RYAN

Examination of products of combustion from typical gas appliances. I. ARTHUR SMITHELLS, et al. *Inst. Gas Eng. 15th Rept.* 1926, 99-161.—A detailed account is given of work on the detn. of small amts. of CO by means of the I_2O_5 method; the accuracy claimed is a few parts in a million for less than 50 per million concn. The rate of flow of the mixt. was one l. per hr. for 4 to 6 hrs. 80 g. I_2O_5 was used between 120° and 220° ; the I_2 liberated was caught over KI soln. and titrated with 0.002 N $Na_2S_2O_3$. The CO content of lab. air was found to be rather high (18 parts per million); outside atm. contained 5 to 10. Several gases were examd. as to their action on I_2O_5 when dild. with pure air; illuminating gas, H_2 (slight action), CH_4 , unsatd. hydrocarbons and C_2H_6 were all found to reduce the pentoxide more or less than CO. S or N oxides present are other sources of discrepancies. Previous work on aeration of high-pressure lighting burners (Keith 1000 c. p.) was continued; the results are given in air-gas ratios (from 2.85 to 4.58) for different operation positions (68-inch pressure). The best illuminating power was for an aeration of 3.48 (theory 3.91). B. J. C. v. d. H.

The production of gas from coal and coke. ERWIN RUSS. *Metall u. Erz* 24, 205-15 (1927).—A discussion of the effects of type of fuel used, fineness of particles, gas pressure, type of generator and temp. upon the production of gases. C. G. K.

Physico-chemical studies of ammonium sulfate production from sulfuric acid and gases containing ammonia. (The Burkheiser ammonium sulfate-bisulfate process.) ERNST TERRES and WALTER SCHMIDT. *Gas u. Wasserfach* 70, 725-8, 762-6, 784 6, 808 13(1927).—Soly. and vapor-pressure measurements were made on the ternary system $NH_4-SO_3-H_2O$ (including both excess acid and NH_3) from 0° to 100° (except in case of excess of NH_3) and diagrams prepd. Crystals of $(NH_4)_2SO_4$ sep. in the NH_3 region and in the H_2SO_4 region up to 20-22% by wt. of free H_2SO_4 . With acid concns. from 22% up to 55-60% a double salt $NH_4HSO_4(NH_4)_2SO_4$ seps. and at higher acid concns. only NH_4HSO_4 seps. Vapor pressures of satd. $(NH_4)_2SO_4$ solns. contg. various percentages of H_2SO_4 were detd. by a modified Brehmer-Frowein tensimeter. The vapor pressures of such solns. decrease with increase of free H_2SO_4 . From these vapor pressures the acid concn. of the $(NH_4)_2SO_4$ saturator and its working temp. may be detd. The partial aq. pressure of the bath must be equal to the partial pressure of the water vapor in the gas if loss or gain of water is to be avoided. When hot coal gas (satd. at $75-80^\circ$) is used as in the direct process the saturator may contain 7-9% free H_2SO_4 and must be operated at 100° or above. With cool gases, as in the half-direct process, the saturator is operated at $40-50^\circ$. The ammonium sulfate-bisulfate process is feasible and possesses advantages over the ammonium sulfite-bisulfite process. R. W. R.

Cycle process for the collection of ammonia from coke oven gases. L. FOKIN. *Chem. Ind. (Russia)* 2, 210 99; *Chem. Zvesti.* 1926, 7, 2070.

and is then evolved in a distn. column, the water again trickles down through a scrubber and so on in a cycle process. In this way, contamination of the scrubber by lime and magnesia and of the distn. column by lime is avoided, burdensome waste waters are eliminated, the installation of heat recovery app. is made possible and lime is saved. The gas water is led with the water from the scrubbers through the distn. column. The

soln. in the column is evapd. by the steam available, but the water evapd. simultaneously with the NH_3 does not balance the gain in vol. of water, and the excess, which contains 0.2–.5% NH_3 (chiefly as $(\text{NH}_4)_2\text{SO}_4$), is used for wetting the coal in the coke ovens. In this way the NH_3 contained in this water is not lost, but the complete recovery of this NH_3 is not accomplished, and in the calcs. it is ignored. The wash water of the scrubbers which passes through the cycle and which contains "fixed" NH_4 salts absorbs NH_3 to the same extent as fresh water in the ordinary process. The "fixed" NH_3 is represented only by that combined with H_2SO_4 , for NH_4Cl is volatile with steam. Since the hot water from the distn. column entrains no small particles, it can be conducted through a tube recuperator where it preheats the water from the scrubbers. The process has been in operation since the early part of 1925 in several coking plants. The yield of NH_3 increased from 0.14% (based on dry coke) to 0.21%, and the cost of the NH_3 diminished 20–30%. The annual production of NH_3 by the new process is about 3000 tons. C. C. DAVIS

Some notes on sulfate of ammonia. (Production of aqueous solution) of ammonia. G. WALMSLEY. *Gas J.* 179, 391–2(1927).—Details are given for a plant to produce 10–12% NH_3 soln. (household NH_3) from NH_4 sulfate. A charge of 14 lb. of sulfate NH_4 will yield 3 to 4 gal. of NH_3 soln. R. W. RYAN

Low-temperature distillation. W. RUNGR. *Mech. Eng.* 49, 875–8(1927).—Descriptions are given of low-temp. distn. processes in the rotary kiln, concentric-drum, and horizontal stationary types of retorts. The heating value of coke, gas, uses for other products obtained in these processes, also necessary selling prices, cost estimates and the economics of location of plant and of markets are discussed. W. W. HODGE

Early theories of coking. G. E. FOXWELL. *Gas World* 87, No. 2244, Coking and By products Sect., 10(1927).—A review. R. W. RYAN

The asphaltic substances in coal tar. GUSTAV ŠEBOR. *Petroleum Z.* 23, 890–7 (1927).—The asphalt content of coal tar has been detd. by different methods with varying results. A method has been developed in which 1 g. tar is dissolved in 10 cc. CS_2 in a 250-cc. Erlenmeyer flask, 100 cc. MeOH added, and the mixt. shaken and exposed to the light for 2 hrs. The clear liquid is filtered off and the residue washed with cold MeOH, and dissolved in pure warm anhyd. benzene. The benzene is evapd. in a Pt crucible and the residue weighed after drying at 105° . The properties of asphaltic substances in the coal tar from the Franz mine in Přívoz have been detd. and the asphalt content has been compared with that of other coal tars. M. B. HART

Naphthalene formation in coal tar. YASABURO KOSAKA AND YOSHIKIYO OSHIMA. *J. Fuel Soc. Japan* 6, 3–8 (English Section)(1927).—Benzene, phenol or any fraction of low temp. acid tar, heated at 850° in contact with coke gave rise to C_{10}H_8 . Benzene and anthracene were also formed from phenols and the cresol fraction. Benzene and toluene were polymerized into C_{10}H_8 and anthracene. In order to explain the formation of C_{10}H_8 in coal tar the following reactions are assumed: $\text{MeC}_6\text{H}_4\text{OH} + \text{H}_2 \rightarrow \text{PhMe} + \text{H}_2\text{O}$; $\text{MeC}_6\text{H}_4\text{OH} + \text{C} \rightarrow \text{PhMe} + \text{CO}$; PhMe polymerizes to C_{10}H_8 with evolution of H_2 ; $\text{PhMe} + \text{H}_2 \rightarrow \text{C}_6\text{H}_6 + \text{CH}_4$; $\text{MeC}_6\text{H}_4\text{OH} + \text{H}_2 \rightarrow \text{PhOH} + \text{CH}_4$, C_6H_6 and PhOH are converted into C_{10}H_8 . NAO UVEI

Preparation of tar for roads. W. O. R. FILLING. *Gas World* 87, 146–7(1927).—Tar for road use is dehydrated at $250\text{--}300^\circ$ in a lead bath heated to $330\text{--}70^\circ$ and provided with light oil and water condensers. Analyses of the tars are given. R. W. R.

The removal of phenol from coke-works waste water. F. RASCHIG. *Z. angew. Chem.* 40, 897–8(1927).—The usual methods of disposing of the Ruhr coke-works waste water contg. phenols and pyridine, which involve their final discharge into the Rhine, create a nuisance that has provoked bitter complaint from the fishery interests, particularly those of Holland. In 1913 the total discharge of water was 5,400,000 cu. meters contg. 27,000,000 kg. of phenol. Acid treatment of the still waste after NH_3 removal in which the phenol is fixed as the lime salt to liberate the phenol is unduly costly and, moreover, the pyridine is not removed. A tentative exptl. plant not yet completely successful treats the raw waste from the ovens with 30% of its vol. of benzene in a counter-current washing tower which effects a 60–70% extn. of the phenol and pyridine. These are later sep'd. from the phenol by distn. and the latter is returned to the washer. Contemplated improvements which include increasing the heights of the washing tower and the fractionating column and the perfecting of methods for removing tar from the raw waste are expected to raise the effectiveness of phenol removal to 80–90%. H. L. OLIN

The comparative utility of cokes, carbonized in five different types of carbonizing plant, as water-gas fuel. R. T. HASLAM, J. T. WARD AND J. H. BOYD, JR. *Proc. Am. Gas Assoc.* 1926, 1083–1104.—Coke produced by carbonization of a Pittsburgh

coal in different types of retort, viz., "D" type at Lowell, Mass., the small Koppers type, the U. G. I., Intermittent Vertical and the Woodhall-Duckham types, were tested as to their utility as water-gas fuels. Comparisons were made first of heat retention during the air blow at varying rates, and second, of other steam-decomp. abilities during the run. As the air-rate increased the percentage of heat retained by the fuel bed decreased especially with the denser cokes, but there was little variation in their reactivities to CO_2 and in their steam-decomp. properties. H. L. OLIN

The determination of phosphorus in coke. "CHYMIST." *Gas World* No. 2240, Coking and By-products Sect., 11-12(1927).—A critical review. It is suggested that the Pb molybdate method be used in which the P is weighed in the form of its equiv. of Pb molybdate. V, Ti and As may cause erroneous results, when present, unless special precautions are taken. R. W. RYAN

Determination of the porosity of coke. N. A. ROSS. *Gas World* 87, No. 2248, Coking and By-products Sect., 15-16(1927); cf. *C. A.* 16, 2982; 17, 2044.—Porosity = [(true sp. gr. — apparent sp. gr.) 100/true sp. gr.] The best way of detg. the apparent sp. gr. of the coke is by means of Hg displacement, as in the water method some water is sure to penetrate into the coke. The real sp. gr. is detd. by boiling the mixt. of coke and water in the sp. gr. bottle for 1 hr. under reduced pressure. R. W. RYAN

Elimination and recovery of phenols from coke-plant ammonia liquor. R. M. CRAWFORD. *Ind. Eng. Chem.* 19, 966-8(1927); cf. *C. A.* 21, 814.—For phenol extn. from ammonia liquor it is now recommended to use light tar oil instead of motor fuel. The extn. efficiency is up to 93%, the soly. in the liquor 1%, no emulsions are formed. B. J. C. VAN DER HOEFEN

Advantages and disadvantages of dry quenching of coke. A. M. BEEBE. *Gas J.* 179, 284(1927).—The Sulzer-Freres coke-cooling plant at the Rochester (N. Y.) Gas and Elec. Corp'n. has a daily capacity of 425 tons of coke. Considerable coke breakage results but as coke is sold to the domestic market this is no disadvantage. Better efficiency is obtained with dry coke in water-gas and producer-gas plants. 1000 lb. of hot coke has given an av. of 420 lb. of steam at 139.2 lb. pressure. R. W. RYAN

Calculation of the theoretical combustion temperatures (Drossback) 2. Production of lubricating oil from coal (NIELSON, BAKER) 22. Utilization of molasses (CROSS) 28. NH_4CNS from coking plants (GLUUD, KLEMP) 18. Progress in ore dressing and coal washing in 1926 (RICHARDS, LOCKE) 9. Alcohol as a by-product of paper manufacture (ANON.) 23. Determination of S in liquid fuels (BOISSELET) 22. Disinfectants from low-temperature tar (GREENBAUM) 17. Recovering volatile solvents from air or gas mixtures [in the coking industry] (Brit. pat. 262,404) 13. Oven for distilling solid fuels (Brit. pat. 261,740) 1. Hydrogenation of coal and oil; synthesis of oils from CO and H (Brit. pat. 261,786) 22.

RICHARD, A.: Les automobiles sans pétrole; l'alcool d'industrie. Paris: Masson & Cie. 222 pp. 18 francs. Reviewed in *Rev. prod. chim.* 30, 569(1927).

Liquid fuels. CARBURANTS ECONOMIQUES, SOC. ANON. Brit. 261,781, Nov. 21, 1925. Liquid fuels such as petroleum, tars, "benzoles and other coal oils," animal and vegetable oils, and alcs. which may be mixed with gasoline, are caused to burn more completely by addn. of a small proportion of substances such as oil of turpentine, oil of capcut, oil of cloves, oil of copaiba, oil of cinnamon, $(\text{CH}_3)_3\text{N}_4$ and its homologs, cymenes, eugenol, isoeugenol, cinnamic aldehyde and similar substances or compds.

Liquid fuel for internal-combustion engines. E. G. E. MEYER. Brit. 262,363, June 12, 1925. Mineral oil or coal-tar distillates b. about 160° or higher are mixed with small proportions of ether and NH_3 or other volatile basic material, with or without MeOH , C_2H_5 or S.

Fuel mixture of coal-tar pitch and fuel oil. T. H. BUTLER, F. J. W. POPHAM, J. C. MANN and H. W. ROBINSON. Brit. 261,907, Nov. 17, 1925. Pitch is heated to a temp. substantially above its m. p. and fuel oil from petroleum or asphaltic material is gradually added. Solid hydrocarbons of the $\text{C}_{16}\text{H}_{34}$ or $\text{C}_{14}\text{H}_{28}$ series, up to 15%, also may be added. A fuel mixt. is obtained which is homogeneous at temps. above 150° . Cf. *C. A.* 20, 2064.

Carbonizing fuel briquets. W. E. TRENT. Brit. 261,954, Feb. 8, 1926. Briquets are heated first to a relatively low temp. (about $230\text{--}300^\circ$) in the presence of O and then to a higher temp. (about $600\text{--}650^\circ$) in the absence of O. An app. is described in

which steam jets may be used to quench the carbonized briquets and prevent overheating of the bottom of the retort used.

Regulating air and fuel supplies in combustion of powdered and atomized fuels. E. S. SUFFERN. Brit. 261,807, May 29, 1925.

Destructive hydrogenation of solid fuels. I. G. FARBENINDUSTRIE AKT.-GES. Brit. 262,099, Nov. 26, 1925. In destructive hydrogenation of fuels contg. moisture such as lignite, peat and moist coal, all or part of the H_2O is first removed by pressing or centrifuging a mixt. of the raw material with liquid hydrogenation products formed from it. The pressing may be effected at 300 atm. pressure and the same pressure may be utilized for forcing the material in the hydrogenation app. where it may be treated with H at a temp. of 400° under 300 atm. pressure.

Fuel briquets. PARK E. WELTON and GEORGE H. WADSWORTH. U. S. 1,642,055, Sept. 13. Granulated or shredded oil refinery residue wax 3 is mixed with sulfite by-product liquor 2 parts, to form a putty-like mixt., and this is mixed as a binder with coal culm 100 parts and with H_2O ; briquets are formed from this mixt. and are set and baked.

Submersible burners for liquid or powdered fuels (for use in steam generation, chemical concentration, etc.). C. F. HAMMOND and W. SHACKLETON. Brit. 261,808, June 2, 1925.

Cracking and carbonizing coal and oil. W. F. TRENT. Brit. 262,302, Feb. 15, 1926. In combined cracking and carbonizing, the heat required is generated at a single source (e. g., a boiler plant), a portion being used to crack the oils and the remainder to carbonize the coal which is agglomerated with the residue from the cracking operation. An app. is described. Cf. C. A. 21, 1348.

Asphaltic materials from destructive hydrogenation of coal, etc. DEUTSCHEN BERGIN-AKT.-GES. FÜR KOHLE- UND ERDOLCHEMIE. Brit. 262,738, Dec. 11, 1925. Asphaltic bituminous materials such as those obtained in the destructive hydrogenation of coal, after removal of H_2O and substances of low b. p., are mixed with gas oil or similar material and allowed to stand to permit solids to settle out. Residual gas oil may be removed from the asphaltic material by distn. with steam.

Inclined preheating chambers and vertical retorts for coking coal. S. W. PARR and T. E. LAYNG. Brit. 261,799, July 30, 1925.

Gas mixture. J. WEBER, H. SCHRADER and E. WIEDBRAUCK. Can. 272,173, July 5, 1927. Gas mixts. rich in ethylene, propylene and butylene are produced by passing the vapors of a hydrocarbon mixt. through and in intimate contact with a bath of molten metal maintained at a temp. of at least 600° , and immediately sepg. the resulting gaseous products from elemental C liberated by the decompn.

Purifying gases and producing ammonium sulfate. F. W. SPERR. Brit. 261,755, Nov. 18, 1925. H_2S is removed from gases by absorption in a wash liquor contg. NH_3 and an Fe or other metal compd. The sulfided liquor is distd. to recover NH_3 and is then aerated to regenerate the wash liquor. The NH_3 used in the latter may be absorbed from the gas being purified, such as coke-oven gases. An app. and numerous details and modifications involving the formation of various NH_4 salts are described.

Apparatus for charging horizontal gas retorts. F. G. MATTHEWS and J. G. W. ADEPINE. Brit. 262,625, Jan. 29, 1926.

Gas producer and rotary agitator construction. FIRM OF H. REHMANN. Brit. 261,797, Nov. 23, 1925.

Gas producer plant. H. F. SMITH. Brit. 262,781, Dec. 14, 1925.

Water-jacketed gas producer or shaft furnace. WOODALL-DUCKHAM (1920), LTD. AND J. W. REBER. Brit. 262,668, July 7, 1926.

Wood-consuming gas-producer. J. R. F. M. LASMOLLES. Brit. 262,088, Nov. 27, 1925.

Apparatus for analysis of flue gases, etc. SIEMENS & HALSKE AKT.-GES. Brit. 262,092, Nov. 27, 1925.

22--PETROLEUM, LUBRICANTS, ASPHALT AND WOOD PRODUCTS

F. M. ROGERS

Reports on the progress of naphthology during 1926. Oilfield practice. A. B. THOMPSON. *J. Inst. Petroleum Tech.* 13, 493-9(1927). Drilling methods and tools. ASHLEY CARTER. *Ibid* 500-2. Retortable materials. E. H. CUNNINGHAM-CRAIG.

Ibid 502-5. Natural gas. D. G. SMITH. *Ibid* 505-9. Chemistry. H. B. THOMPSON. *Ibid* 509-17. Refining and refineries. J. MCC. SANDERS. *Ibid* 517-30. American refinery technology. B. T. BROOKS. *Ibid* 530-7. Refining in Europe. H. I. WATERMAN and J. N. J. PERQUIN. *Ibid* 537-46. Fractionation of petroleum. E. H. LESLIE. *Ibid* 546-57. Cracking. R. PITKETHLY. *Ibid* 568-78. Antidetonators. G. B. MAXWELL. *Ibid* 578-81. Lubricants. HAROLD MOORE. *Ibid* 581-7. Heavy distillates, fuel oils, asphalts and residues. F. H. GARNER. *Ibid* 587-92. Special products. W. J. WILSON. *Ibid* 592-4. Paraffin wax, oxidation products, insecticides and naphthenic acids are mentioned. Analysis and testing of petroleum. J. S. JACKSON. *Ibid* 595-7. Synthetic fuels. A. W. NASH. *Ibid* 597-601. Oil engines. J. F. ALCOCK. *Ibid* 601-7. Oil and gas developments in Canada. G. S. HUME. *Ibid* 607-9. British West Indies. A. P. CATHERALL. *Ibid* 609-11. Shale-oil research in Esthonia: Chemical composition and autoxidation of light distillates. P. N. KOGERMAN. *Ibid* 612-5. World's production of crude petroleum. GEORGE SELL. *Ibid* 615-6. E. H.

Petroleum and petroleum products. ARTHUR KNAPP. *Mineral Ind.* 35, 482-511 (1926).—A review of world production, including oil shale and natural gas, and discussion of advances in petroleum technology. A. BUTTS

Review of the patent literature of the petroleum industry during 1926. RICHARD KISSLING. *Petroleum Z.* 23, 861-4(1927).—The petroleum patents from various countries are classified numerically according to the type of operation covered.

M. B. HART

Gasoline—past, present and future. A. LUDLOW CLAYDEN. *J. Soc. Automotive Eng.* 21, 277-80(1927); discussion, 280-5.—A brief review of the development of gasoline manuf. and present tendencies in the field. An ideal fuel should have a practically const. volatility, under all operating conditions. There is no danger from S in the gasoline of today in the amts. allowed by government specifications. M. B. HART

Results of viscosity tests on several Rocky Mountain crude oils. H. L. KAUFFMAN. *Oil Weekly* 46, No. 10, 33-4(1927).—The viscosities at 75°, 100°, 125°, and 150° F. of Ferris, Salt Creek, Lost Soldier, Wyo. and Craig, Col. crudes are tabulated. M. B. H.

The Polish petroleum industry in 1926. TADEUSZ SPITZER. *Petroleum Z.* 23, 835-48(1927).—Statistics. M. B. HART

Artificial mineral oil. ANON. *Petroleum Times* 18, 277-8(1927).—Progress is reported in the use of the Bergius process for the treatment of coal with H₂ as developed by the I. G. Farbenindustrie A. G. M. B. HART

Water flooding practical in shallow fields of high-grade oil. L. C. UREN. *Nat. Petroleum News* 19, No. 34, 62-4, 56-8, 60(1927).—A review of the literature and work done, with special reference to the Bradford field. M. B. HART

Sulfur in Esthonian oil shale (kukersite) and in its distillation products. M. WITTLICH. *Acta Comment. Univ. Dorpatensis* 8, AVIII, 6, 1-12; *Chem. Zentr.* 1926, II, 303.—The various oil shale beds and the distn. products in the production of coke and tar were analyzed for their S content. C. C. DAVIS

An analytical examination of some South Dakota cretaceous shales. CHARLES WATERMAN. *Black Hills Eng.* 15, 166-71(1927).—A series of assays indicate that the 700-ft. bed of Graneros and the 1200-ft. bed of Pierre shales underlying South Dakota east of the Black Hills contain only a trace of oil and a negligible quantity of N. R. A. BAXTER

Investigation of the crude from Nienhagen, Kreis Celle (Hannover). L. ROSNER. *Petroleum Z.* 23, 940-1(1927).—Distn. and refining data show that this crude may be distd. and treated without danger of cracking or emulsion formation. M. B. H.

Further formolitic analyses on crude naphtha. A. M. NASTIUKOV. *Tekh. Ékon. Vestnik (Russian)* 6, 501-6(1926); cf. C. A. 20, 498.—This is the continuation of a study on the detn. of the formolitic number of various crude oils. J. S. JOFFE

Determination of sulfur in mineral oils and liquid fuels. L. BOISSELET. *Ann. office nat. comb. liquides* 2, 37-45(1927).—A crit. review of different methods, with a detailed description of the method used at the lab. of the École Nationale Sup. du Pétrole et des Combustibles Liquides. A. PAPINEAU-COUTURE

A new sulfur test for oils. JAMES SCOTT. *Petroleum World (London)* 24, 347-8 (1927).—A discussion of the method for the detn. of S in petroleum products as presented by E. S. Squire (C. A. 21, 2786). Photomicrographs of crystals of the compds. formed are presented. M. B. HART

The index value and the index value calculation. E. KROCH. *Petroleum Z.* 23, 936-9(1927).—A reply to Ostwald (cf. C. A. 21, 2786). M. B. HART

West Texas development calls for best of engineering skill. A. R. McTEE. *Oil Weekly* 46, No. 8, 41(1927).—Gas found in Crane and Upton Counties contains about 12% H_2S as it comes from the well. Methods used in treating it include the use of soda soln. or soda with kerosene. Various soda-treating plants are described. The chem. analysis of water from shallow wells in McCamey Field, and Pecos River, Upton County, is also given. M. B. HART

Industry's technicians responsible for extraction methods. G. S. REID. *Refiner Natural Gasoline Mfr.* 6, No. 8, 59-60, 64(1927).—Com. absorption methods for the betn. of natural gasoline in gas are reviewed. M. B. HART

Gasoline absorption plant (M. M. Tikhvinskii's process). G. SARKIS'YANZ. *Azerbejdj. Oil Industry* 1927, No. 6-7, 55-63.—An inert gas slightly preheated is forced through a stream of crude oil and thus satd. with gasoline. The preheating is done by compressing slightly the well gas contg. a certain amount of gasoline vapor. The final extn. of gasoline from gas is obtained by compression and cooling. This method is applied to gas-lift oil wells to strip the crude oil from a part of the gasoline. A. A. BOEHLINGK

Recent improvements in crude-oil refining. WILTON SHELLSHEAR. *Chem. Eng. Mining Rev.* 19, 397-402(1927). E. H.

Application of process steam in petroleum refining. A. G. PETERKIN, JR. *Chem. Met. Eng.* 34, 544-5(1927). E. H.

First plant for the removal of benzine from petroleum in Schubany. V. SHPEROVICH. *Neftyanoe Khozyaistvo* 10, 93-6; *Chem. Zentr.* 1926, II, 304.—Before shipping crude petroleum from the Schubany fields, 17% is removed by distn. on the spot, for otherwise the low-boiling fractions would be lost in large quantities during transport in conductor pipes. This 17% of the distd. product is used as benzine. C. C. DAVIS

Kerosene-distillation plant with a regenerative system. S. ZADOLIN. *Azerbejdj. Oil Industry* 1927, No. 6-7, 39-44.—In a continuous distn. plant heat exchangers are extensively used and other improvements added. Claims are made of 65% economy in fuel. A complete layout of plant with drawings is given. A. A. BOEHLINGK

Rectification of gasoline from crude oil. G. TOROSYAN. *Azerbejdj. Oil Industry* 1927, No. 6-7, 48-51.—A rectifier adapted to a continuous distn. unit is described with equations, drawing, layout, etc. A. A. BOEHLINGK

The kerosenes of Grozny. L. SELSKII. *Neftyanoe Khozyaistvo* 9, 742-53(1925); *Chem. Zentr.* 1926, I, 2990.—On economic grounds the kerosenes have recently all had removed, for use in benzine, the fractions boiling up to 200°, and in many cases have had the fractions up to 225° removed. The effects of these changes on the combustibility and illuminating power of the kerosene were investigated. To utilize the kerosene as a light oil after such treatment, the fractions boiling above 270° must also be removed. The product between these narrow limits has a flash point of about 60° and a long "latent" period up to the point where the illuminating power reaches its max. If the fractions above 270° are not removed, a special burner, with preheating of the kerosene, must be employed. Data on the kerosene contents of Grozny petroleum are included. C. C. DAVIS

Grozny crude oils and the refining process. S. A. VYSHETRAVSKY. *Azerbejdjanskoe Neft. Khoz.* 1927, No. 3, 53-9.—Tests on diff. fractions in diff. stages of the refining process are described. Grozny crude oils are paraffin base, semi-paraffin base and non-paraffin base. A. A. BOEHLINGK

Export-gasoline from the first distillation. N. A. ALEXEYEV. *Azerbejdjanskoye Neft. Khoz.* 1927, No. 3, 49-53(1927).—Vapors from the still pass through a dephlegmator surrounded by a jacket contg. a const-boiling liquid. Sepn. from heavy ends obtained that way. For export-gasoline the const-boiling liquid is toluene. Full data are given on equipment, yields, etc. A. A. BOEHLINGK

Sulfur in gasoline and water-white oil from Bak. L. GOOKHMANN AND V. KAMENOV. *Azerbejdjanskoye Neft. Khoz.* 1927, No. 5, 63-7.—Gasoline and water-white oil from Surakhany, Balakhany and Bibi-Eibat were tested for S. Foreign gasolines and water-white oil tested in Bak were higher in S. The highest corrosion by sulfur in water-white oil was caused by the water-white oil from Surakhany followed by Balakhany and Bibi-Eibat. In gasoline only the sample from Bibi-Eibat showed corrosion. The Döbner test is not a proof for corrosive action of S. A. A. BOEHLINGK

Calculations for a tube still for gasoline and water-white oil. A. I. KHMELNIKOV AND V. P. VOINOV. *Azerbejdjanskoye Neft. Khoz.* 1927, No. 4, 50-62.—The following are given, complete calcn. for a tube-still equipment, preliminary calcn. on heat required, fundamentals on the heating and evapn. of oil products, conditions for heating

and evapn. temps., amount of oil in the heat treatment, heat capacity of oil, heat of evapn. of oil, amount of heat required by the oil. Equations and tables are included.

A. A. BOEHLINGK

Utilization of the heat in flue gases. S. S. KRIVOSHÉIN. *Azerbeidjanskoye Neft. Khoz.* 1927, No. 4 38-42.—A review of the problems in connection with heat exchangers and utilization of flue gases for preheating of oils. Data are given on gasoline, water-white oil, petrolatum, asphalts, lubricating oils and steam superheaters.

A. A. BOEHLINGK

Utilization of flue gases for preheating oil. N. A. ALEXÉYEV. *Azerbeidjanskoye Neft. Khoz.* 1927, No. 1, 43-8.—Full information is given with regard to equipment; equations and drawings are included. Flue-gas heat-exchangers are suggested to preheat distillates used for water-white oil. These exchangers are to be connected behind the usual heat exchangers.

A. A. BOEHLINGK

Rectification of water-white oil. K. V. KOSTRINE. *Azerbeidjanskoye Neft. Khoz.* 1927, No. 3, 35-46.—From his own expts. and from information from other sources K. concludes that: (1) The yield of water-white distillate is increased considerably and color and mixt. of fractions will be of a much higher grade if rectification columns are used for water-white distn. from crude oil. (2) The rectification columns eliminate from the water-white the heavy ends from the gasoline and the light ends from the solar-oil fraction. The phlegma is stripped off the light ends of the water-white. From gasoline they eliminate the light water-white fractions and from the phlegma the gasoline. (3) Therefore both rectifying columns have to be provided with some equipment for additional evapn. for the phlegma. Superheated steam is used and an additional equipment for rectification. (4) The spray liquid has to be pumped to the top of the columns; it consists either of gasoline or water-white distillate. (5) The columns for gasoline or water-white distn. should be filled up with bricks, providing a very large surface. (6) The use of rectification columns will considerably increase the fuel and steam consumption.

A. A. BOEHLINGK

Scheme of a gasoline topping plant for diatomic crude from Binagady. G. A. SARKISSIANTZ. *Azerbeidjanskoye Neft Khoz.* 1927, No. 2, 69-72.—In a proposed plant for a continuous distn. of gasoline the still is heated with superheated steam (170°) in 2 sets of coils covered with corrugated iron sheets. The crude oil is run by gravity from a tank, flows through jets and drops on the hot iron sheets. The partly stripped crude flows down and comes into contact with the sheets on the lower steam coil. The escaping gasoline vapor has a temp. of 150°. The stripped crude leaves the still through the bottom, passing a heat exchanger, to a storage tank. A bubble tower is provided to give close cuts of gasoline. Calens., cost figures, a full description and a drawing of the plant are given.

A. A. BOEHLINGK

Investigation of the residue after the purification of petroleum benzine. A. DOBRVANSKII AND ALIEV. *Neftyanoe Khozaystvo* 9, 229-32(1925); *Chem. Zentr.* 1926, II, 676.—Two hydrocarbons were isolated, one of which was identified by its b. p. of 226.5-74.5°, its *n* value and its analysis as 2-phenylheptane.

C. C. DAVIS

Continuous treatment of light oils. Y. E. EMMUIL. *Azerbeidj. Oil Industry* 1927, No. 6-7, 64-7.—In a plant for continuous treatment of gasoline and water-white oil, 5 towers, connected in parallel, are filled with H₂SO₄. The acid enters the towers on the upper part and is continuously withdrawn from the bottom. The oil enters the towers through fine holes in the lower part, passing the acid in very fine drops and having a large surface for reaction. The oil collected on the top part of the towers is lead through pipes to a tower contg. soda soln. This tower works on the same principle. As no stirring is required and the whole process is carried out in closed containers, the loss in oil is extremely small.

A. A. BOEHLINGK

Ryan refining process manufactures marketable products without customary treating. C. A. ZIMMERMAN. *Oil Age* 24, No. 8, 27, 72(1927).—The Ryan distg. process produces finished gasoline without treating and consists in distg. crude in 2 stills, the first taking off gasoline, and the second kerosene, engine distillate and stove distillate. The residuum is pumped into fuel oil storage. H₂O in amts. averaging 4% or more is added to the crude, and forms steam for use in sepg. S and C from the light vapors and is said to convert the S from a corrosive to a non-corrosive form. The fuel oil residuum makes good cracking stock.

M. B. HART

Arizona halloysite suitable for clay pulp contact filtration. H. L. KAUFFMAN. *Refiner Natural Gasoline Mfr.* 6, No. 8, 68-9, 72-4(1927); cf. *C. A.* 20, 3562.—Halloysite, a clay from Eastern Arizona, has been compared with 100-mesh Georgia fuller's earth to det. its filtration efficiency. Fifty % acid-treated halloysite pulp, prep'd. by the addn. of 50% 66° B. H₂SO₄, dilg. to 20% acid concn., digesting for 5 hrs. at 200°

F. and washing with 4 portions of H_2O at $180^\circ F.$, has proved to be 10 times as efficient as fuller's earth on a neutral cylinder stock having a viscosity of 133 at $210^\circ F.$, 9.4 times on a Calif. asphaltic base neutral oil with viscosity of 200 at $100^\circ F.$, 5.7–7.0 times on paraffin base neutral oil, 5 times on a $440^\circ F.$ long residuum, acid stage. M. B. H.

Fire fighting in oil refineries. F. A. EPPS. *Quarterly Nat. Fire Protection Assoc.* 21, 32–40(1927).—A summary of tank fire records shows a great superiority of air-tight steel roofs. Fifty-five% of the tank fires are caused by lightning; 93% of these are in tanks not gas tight, mostly with wooden roofs. An outline is given of proper construction, operation and fire protection for tanks and distn. equipment, with notes on the limitations and methods of use of dry chem. and stored liquid foam systems. C. L. J.

Autoxidation and anti-oxygen effect. XXIII. Autoxidation of liquid fuels when heated. Application to the problem of "knock" in motors. CHARLES MOUREU, CHARLES DUFRAISSE AND RENÉ CHAUX. *Chimie et industrie* 18, 3–12(1927); cf. C. A. 20, 3374, 3625; 21, 1914, 2380, 3451.—The exptl. work on autoxidation of liquid fuels (paraffin, hydrocarbons, vegetable and marine animal oils) and on the anti-O and pro-knock power of various substances, particularly those known to possess anti-knock or pro-knock properties, which is referred to in paper XXIV of the series is given in greater detail, the app. used and method of carrying out the tests being described and the results given graphically. A. PAPINEAU-COUTURE

Blending of gasoline with aromatics. V. I., SHIPEROVICH AND G. R. WEINSTEIN. *Azerbaidzanskoye Neft Khoz.* 1927, No. 1, 40–3.—A blend of 20% benzene and 80% gasoline from Grozny (paraffin-base) crude oil gives an anti-knock motor gasoline of high quality. Crude benzene is purified by distg. off 90% 3 times in succession, treating with 3% H_2SO_4 , washing, neutralizing, washing and steam-distg. 99%. The following figures give, resp., sp. gr. and initial b. p.: Grozny light export gasoline 0.7208, 54° ; the same blended with 20% benzene 0.7492, 54° ; Grozny heavy export gasoline 0.7445, 61° ; the same blended with 20% benzene 0.7631, 64° ; Grozny gasoline grade II 0.7311, 59° ; the same blended with 20% benzene 0.7506, 48.5° . A. A. BOEHLINGK

Gas oil-fuel oil blends to make road oil. H. L. KAUFFMAN. *Refiner Natural, Gasoline Mfr.* 6, No. 8, 88, 90(1927).—Fuel oil bottoms, from Simpson Ridge (Wyo.) crude oil, having the following properties: A. P. I. gr. 13.6° , flash $565^\circ F.$, fire $655^\circ F.$, Saybolt Universal viscosity at $210^\circ F.$, 1002, % asphalt of "100 penetrations" 96.8, have been blended with gas oil bottoms resulting from the rerunning of Dubbs pressure distillate having A. P. I. gr. 31.9° , flash $205^\circ F.$, fire $275^\circ F.$, and the flash, fire, viscosity, and asphalt content of the products detd. The most satisfactory oils from the standpoint of asphalt content are those blends in which the ratios of fuel oil and gas oil are 5:25 and 62.5:37.5. M. B. HART

The cracking of Gabian petroleum by the anhydrous aluminum chloride process. ANDRÉ GRAETZ. *Ann. office nat. comb. liquides* 2, 69–91(1927).—(In treating dehydrated and refined (with H_2SO_4 and NaOH) Gabian petroleum (which has an initial b.p. of 217°) with increasing proportions of $AlCl_3$, the max. yield (74.5%) of light products (above up to 210° in the de Luynes-Bordas app.) was obtained with 9% $AlCl_3$, wt. in crude petroleum, the same degree of max. cracking was obtained, but with 11–15% $AlCl_3$, the increase in $AlCl_3$ consumption was due to the action of H_2O and S and oxygenated compds. in the crude. On distg. the crude to 340° and treating the distillate (without refining) with $AlCl_3$, the same max. cracking was obtained with 12% $AlCl_3$, because of evolution of considerable H_2S during distn. of the crude. Investigation of the formation of metal chloride complexes with petroleum led to the following conclusions: (1) Sn^{IV} , S, Hg^+ , Cu^+ , Fe^{III} and Na chlorides and bleaching powder form complexes with the cracking oil on heating for a suitable length of time; (2) these complexes are sol. in the Cl derivs. of CH_4 , C_2H_6 and C_3H_8 , in which all the H has not been substituted by Cl, and they are insol. in the Cl derivs. in which the H has been completely substituted; (3) in order that cracking may be catalyzed by a metal chloride, the latter must be volatilized or decompd. between 190° and 210° . The mechanism of the cracking may be considered as due to the formation of a hydrocarbon-metal chloride complex, which is decompd. at the distn. or decompn. temp. of the metal chloride, with a breaking up of the C chain into lower-boiling products. The min. cracking temp. of oil is 160° , and at 200° the reaction is well started; the complexes formed by chlorides boiling at a lower temp. (e. g., $SnCl_4$, $SbCl_5$) decomp. before the min. cracking temp. is reached; the complexes formed with high-boiling chlorides (e. g., $FeCl_3$) are very stable, so that cracking cannot take place below 250 – 60° ; the $AlCl_3$ complex can crack into lighter products. Investigation of the decompn. of the $AlCl_3$ -hydrocarbon complex showed that at atm. pressure it begins at 150 – 60° , is fairly active at

190–210° and is complete at 230–40°. It would therefore be preferable to carry out the cracking at 240–5°. Because of limitations of the lab. equipment used, the results obtained are less favorable than would be obtained on an industrial scale. G. considers that under ordinary circumstances the process could not compete economically with other processes (e. g., Dubbs'); but that it might be of considerable use in emergencies.

A. PAPINEAU-COUTURE

Cracking in the liquid phase at atmospheric pressure. A. G. ZAKHARENKO AND K. V. MISTCHENKO. *Azerbeidzanskoye Neft. Khoz.* 1927, No. 4, 42–50.—Fuel oil contg. some water-white is not suitable for cracking under atm. pressure. Cracking begins after the stripping of the light ends (water-white) and raising of the oil temp. in the still to 380°. The rate of cracking doubles with every 10°. Not more than 50% of the fuel oil should be distd. off; distn. of more than this makes it difficult to remove the residue left in the still. Too high temps. are harmful to the still. Distn. curves and other data are given.

A. A. BOEHLINGK

Manufacture of light concentrated extracts of sulfonic acids from vaseline oil. P. MONTAG. *Azerbeidzanskoye Neft. Khoz.* 1927, No. 1, 48–51.—The reagent "Kontakt" is a pitch-black to dark-blue, viscous liquid, with SO₂ odor. It contains sulfonic acids over 40%, mineral oil 15%, H₂SO₄ 3%. It is used in soap manuf., and the textile industry particularly for silks and woollens. In its manuf. vaseline oil is treated successively 4 times with H₂SO₄ and 20% SO₃, and the sulfonic acids are extd with H₂O. The acid-treated oil is cooled each time to 15–20°. The first and second extns. are carried out with fresh H₂O, the third and fourth with extracts of acid from the first two extns. The process is covered by Russ. Patent No. 803,428.

A. A. B.

Greases and their manufacture. GEO. W. CUPIT. *Refiner Natural Gasoline Mfr.* 6, No. 8, 55–6, 64(1927).—A general discussion of components and the method of preparing cup, sponge, fiber and graphite greases.

M. B. HART

Automotive lubricants. L. W. PARSONS. *Ind. Eng. Chem.* 19, 1116–9(1927).—An address.

W. F. FARAGHER

The production of turbine oils. V. VLASSENKO. *Neftyanoe Khozaystvo* 10, 243–4, *Chem. Zentr.* 1926, II, 306.—Directions are given for the production of turbine oils T and L from machine oil and spindle oil, and the production of turbine oil M by mixing T and L grades. With these methods, decolorizing powders are unnecessary.

C. C. DAVIS

Method of estimating lead in lubricating oils. ALFRED E. LEVEY. *Chemist-Analyst* No. 47, 7(1926); *Chem. Zentr.* 1926, II, 1711.—Carefully ignite 3 g. of material, leach the ash with 100 cc. of 4 N HNO₃, dil. to 150 cc. and electrolyze.

W. T. II.

Production of lubricating oil from coal. HARALD NIELSON AND STANLEY BAKER. *Engineering* 123, 665–6(1927).—The lubricant was refined by Sensible Heat Distillation Ltd., London, from crude oil prepd. by them from cannel coal by the "L and N" process. On distn. this oil gave in % by vol. and on dry basis, resp.: up to 300° 16.5, 17.5; 300–350° 13.6, 14.6; 350–370° 9.8, 10.5; above 370° 41.70, 45.0; pitch 7, 7.5; water and loss 12.5, loss 4.9. The distillate above 370° was refined for lubricating oils. The tar acids, amounting to 20% by vol., were removed by NaOH and the residue was refined with 3% H₂SO₄, leaving 70% of the original material or about 30% of the anhydrous crude oil. The treated oil was redistd. and the first 25% discarded to kerosene. The remainder was filter-pressed at about –5°, and the wax-free oil redistd., giving a dark red oil with a marked green fluorescence. Some medium oil of d₁₅ 0.981 from this distillate was compared with some refined mineral oil of d₁₇ 0.901 in the National Physical Lab by journal friction tests. Comparison curves show a min. coeff. of friction of about 0.0015 up to 800 lb./sq. in. load with each oil, the lubricant from coal being slightly inferior at low and slightly superior at high bearing pressures as compared to the particular mineral oil tested. Also in *Mech. Eng.* 49, 1109–10(1927).

R. A. BAXTER

Asphalt. PREVOST HUBBARD. *Mineral Ind.* 35, 75–82(1926).—Gives data on production and trade, and tests and specifications.

A. BUTTS

The constitution of the asphalt micelle. F. J. NELLENSTEYN. *Chem. Weekblad* 24, 414–21(1927).—The 3 components of asphalt, i. e., medium, protective substances and the C particle, are arranged in such a way that the medium forms the outer layer. The protective substances with the C particles form the asphalt micelle, in which the C is placed at the center. The relation between micelle and medium is principally ruled by their interfacial tension. Reversible flocculation is caused by adding liquids which have a low surface tension and which increase the interfacial tension. Irreversible flocculation occurs by destruction of the micelle and depends upon the adsorption qualities of the reagents. The carbon, as the center of the micelle, stabilizes the whole

system and must be considered as an essential component. The definition of asphalt as a highly protected oleosol is confirmed in all respects. M. ACHTERHOF

Filler for asphalt mixtures. E. BARTON HACK. *Commonwealth Eng.* 15, 29-31 (1927).—Expts. were conducted to obtain a filler, commercially procurable, corresponding in fineness to hydrated lime without the objectionable features unseparable from that material. The function of a filler for bituminous asphalt is so to multiply the no. of voids that their vol. is so negligible that they are non-permeable to water and form a solid mass, approx. coördinate with the surrounding aggregates. From ascertained wts., it is possible to calc. a table of figures, based upon the logical assumption that the sp. gr. of the fine particle remains the same as the mass in the matrix. Objections to such materials of extreme fineness as lime, stone dust, slate dust, ground silica, dust from crushing plants, etc. are the tendency to "ball" after drying and pulverizing. Marls and ground material from crushing plants usually contain talcy or micaceous particles that are unstable and split and open out through the tensions set up under the compression and expansion of the roadway. W. H. BOYNTON

The softening point of pitch and asphalt according to G. Kraemer and C. Sarnow. HEINRICH MALLISON. *Z. angew. Chem.* 40, 927-8(1927).—For the softening point detn. of K. and S. a heating rate of 1° per min. is recommended; deviations as high as 3° were found on heating at a rate of 2° per min. B. J. C. VAN DER HORVEN

Action of catalyzers in the distillation of wood. G. DUPONT and R. LASCAUD. *Ann. office nat. comb. liquides* 2, 21-36(1927); *Bull. inst. pin.* No. 37, 145-51.—The expts. were carried out on pine sawmill waste (12 cm. wide by 3.5 cm. thick) in a 30-l. steel retort, placed on a wood-fired brick furnace. Distn. lasted 6 hrs. and was conducted so as gradually to heat the wood to 500° as shown by a pyrometer placed in the mass of wood. The catalyzer was added by immersing the wood 30 min. in boiling water, transferring to the soln. of reagent, withdrawing at the end of 48 hrs., and allowing to dry for 8-10 days. Comparison of the action of various catalyzers (all used at a concn. of 1%) showed: (1) hot water alone appears to reduce the tar and AcOH yields slightly and to increase the MeOH yield slightly; (2) NaOH increased the MeOH yield about 5 fold, but reduced the tar and AcOH yields by about 33% each; pulp mill black liquor had approx. the same effect; Na₂CO₃ was somewhat less active; (3) CaCl₂ reduced the tar yield without appreciable improvement in AcOH or MeOH yields; (4) NaHSO₄ and phosphoric acid slightly increased the MeOH yield but reduced the tar and AcOH yields. The MeOH yield is max. with 1% NaOH in the impregnating soln., while with 2-3% NaOH it is practically the same as without catalyzer; the AcOH and tar yields are greatly reduced (loss of 33-50%) with 1% NaOH, and then the reduction proceeds more slowly with greater concns. The charcoal yield depends on too many other factors to judge how it was affected by the treatment. Comparison of the action of NaOH on pine and on a no. of hardwoods (oak, hornbeam, elm, poplar, beech, plane and balsam "sapin") showed a much smaller proportional increase in MeOH yield, old wood showing a much greater increase, on the whole, than young wood; the yield of AcOH was not affected to any great extent; while the tar yields were increased in some cases and reduced in others. The possible economic importance of the results is discussed. A. P.-C.

Machine for testing lubricating oils (ANON.) 1. Cracking and carbonizing coal and oil (Brit. pat. 262,302) 21. Strainer for gasoline (U. S. pat. 1,642,433) 1. Drying SO₂ [for use in refining hydrocarbons] (Brit. pat. 261,732) 18. Fire-extinguishing device for use in oil tanks, etc. (Brit. pat. 262,697) 18. Apparatus for treating acid sludge with salt solution (U. S. pat. 1,642,060) 1.

ASCHER, R.: *Les lubrifiants*. Translated from German into French by George Lohr. Paris: Ch. Béranger. 249 pp. Reviewed in *Ann. office nat. comb. liquides* 2, 330 2(1927).

MICHELL, A. G. M.: *Viscosité et lubrification*. Translated from English into French by A. Troller. Paris: Gauthier-Villars & Cie. 68 pp. Reviewed in *Ann. office nat. comb. liquides* 2, 450-1(1927).

Oil purification. L. H. CLARK. *Can.* 271,998, June 28, 1927. Impure oil contg. ely divided C is purified by dispersing throughout the oil an aq. reagent having a weak alk. reaction and having the property of facilitating the passage of carbonaceous impurities from the oil into the aq. phase of the resulting mixt. The aq. phase is then sep. from the oil.

Refining mineral oils. T. HELLTHALER. U. S. 1,643,272, Sept. 20. Oils are

treated at room temp. with TiCl_4 or other Ti tetrahalide dild. by "inert substances" such as fuller's earth, activated C, infusorial earth, clay, Na_2CO_3 or CaCO_3 .

Treatment of petroleum residues. F. M. ROGERS. Can. 272,004, June 28, 1927. The crude-oil residue, obtained by distn. and representing not more than 10% of the original crude oil, is dild. with hydrocarbon oil of lower viscosity, and the dild. oil is treated with H_2SO_4 . The diluent is removed from the settled oil.

Prevention of emulsions in petroleum products. E. B. COBB. Can. 273,542, Aug. 30, 1927. H_2SO_4 -treated oils are maintained at a temp. of $350\text{--}500^\circ\text{F}$. until such emulsion-inducing compds. are decompd. The oil is then washed with an acid soln.

Hydrogenation of coal and oil; synthesis of oils from carbon monoxide and hydrogen, etc. J. TRAUTMANN. Brit. 261,786, Nov. 21, 1925. Heat required for various processes is supplied to the reacting substances by finely divided heated metal which may be in the form of powder, liquid or vapor. Coaxial nozzles may be used, through the inner of which the reagents pass while the hot metal is supplied through the outer. Brit. 261,787 specifies carrying out similar reactions while employing molten Sn or other suitable catalyzers which may be brought into contact with reacting substances by "threshing" or centrifugal action. An app. is described.

Cracking oils. U. S. JENKINS. Brit. 262,666, June 25, 1926. In distn. or cracking under pressure, the residuum in a retort is continuously removed to an evaporator where the lighter fractions are evapd. under reduced pressure by latent heat. An app. is described. The oil may be mixed with an absorbent such as fuller's earth, lime, clays or SiO_2 gel.

Cracking hydrocarbons. C. P. TOLMAN. U. S. 1,643,036, Sept. 20. Hg vapor, superheated to above the cracking temp. of the oil, is brought into contact with vapor of the oil to effect cracking of the latter. An app. is described.

Purification of cracked hydrocarbons. T. T. GRAY. Can. 273,411, Aug. 30, 1927. Cracked hydrocarbons are passed in vapor form into contact with a body of solid absorbent material, thus depositing a polymerized compd. on the material. The pressure of the vapors in the presence of the material is regulated so as to produce condensation of a portion of the same. The condensate is passed through the material to remove the polymerized compd., the vapors and liquids emerging from the material being sepd.

Conversion of heavy into lighter hydrocarbons. V. W. NORTHRUP. U. S. 1,642,624, Sept. 13. Vapors of heavy hydrocarbons such as those of fuel oil in mixt. with H or natural gas or other gas contg. available H are passed through an electrifying zone and then through an independent catalyzing zone which may contain Fe and Al or other catalysts.

Retort for distilling oil shale, etc. H. J. McELVAIN and H. C. McELVAIN. U. S. 1,642,457, Sept. 13.

Device for collecting average samples of liquids passing from oil stills, etc. D. J. ELLIOTT and G. C. JONES. Brit. 261,784, Nov. 21, 1925.

Revivification of fuller's earth used in treating hydrocarbon oil. F. W. HALL. Can. 271,630, June 14, 1927. The occluded coloring matter is removed by treating with a solvent consisting of a large proportion of gasoline and a small proportion of acetone. Can. 271,631 specifies as solvent benzene instead of gasoline.

Lubricant. C. A. MILLER and C. B. KARNS. Can. 272,855, Aug. 2, 1927. A solid lubricant comprises a viscous hydrocarbon oil and sodium stearate in equal proportions, with H_2O and free alkali in quantities of less than 1% each.

Preserving lubricating and transformer oils, etc. F. HOFMANN and M. DUNKEL. Brit. 262,107, Nov. 24, 1925. Darkening and polymerization and sludge formation in oils which are exposed to air at elevated temps. are lessened by the addn. of 5% of $(\text{CH}_3)_4\text{N}_4$, 1% of $(\text{CH}_3\text{O})_3$, 1% of urea or similar small proportions of other compds. such as aldehydes and their condensation products, bases, nitriles, oxamides, acids or their derivs.

Emulsions of bitumens, oils, rubber, etc. G. BAUME, P. CHAMBIGE and D. BOUTIER. Brit. 262,724, Dec. 8, 1925. In making emulsions for treating roads or for other purposes, the operations of melting the raw material, heating H_2O and mixing and emulsifying the ingredients are all carried out in a pitch furnace or other single container.

Bituminous mixture. R. CROSS. Can. 272,245, July 12, 1927. A mastic is composed of a mixt. of asphaltic cement and not less than 10% of a vesicular inorg. material.

Asphalt slabs and sheets. F. C. J. DE BORT. U. S. 1,643,059, Sept. 20. A substantially pure mass of asphalt is poured in heated condition to form a sheet, partially cooled to a plastic condition, and the thickness of the sheet is then gradually reduced and it is smoothed in successive stages and cut into slabs or plates.

23—CELLULOSE AND PAPER

CARLETON E. CURRAN

Nitrocellulose collodions and celluloid films. ANDRÉ BRÉGUET. *Rev. gén. mat. plastiques* **2**, 215-25, 297-302, 429-35, 507-13, 563-7, 629-43, 679-85(1926); **3**, 71-7, 368-71, 487-98(1927); cf. *C. A.* **19**, 3590.—After a review of the stability and viscosity of nitrocellulose (I) collodions, B. describes in detail an extended series of expts. which he carried out with a view to det. the causes and mechanism of the evolution of I collodions and of celluloid films on aging. The results are presented in tabular form and graphically and are discussed at length. The action of moderate heat and light on celluloid, and particularly on movie films, chiefly brings about a modification in the colloidal structure of the product, without any great change in the volatile matter content or in the N content of the I. This modification is revealed by a progressive fall in the viscosity of the Me_2CO sols. Light and heat cause a similar progressive reduction in the viscosity of Me_2CO collodions of I, which further justifies the assumption that celluloid is a solid colloidal dispersion of I in camphor. Addn. of small quantities of NH_3 , or of $\text{C}_6\text{H}_5\text{N}$ also reduces the viscosity of I collodions with time; but in this case the phenomenon is complicated by a chem. reaction between the added base and I. Fractional pptn. of I *via* Duclaux and Wollmann (*C. A.* **14**, 3154) furnishes a method of following the colloidal modification undergone by collodions or celluloid under the effects of heat or of light. Pptn. of Me_2CO sols. of I by progressive addn. of C_6H_6 generally gave 4 ppts., the 1st 2 having high and the last 2 low viscosities. After moderate action of light or of heat on collodion or on a celluloid film, and also on a movie film which had been worn out by use, the N content of the several ppts. was hardly changed; but on the other hand the proportion of the high-viscosity fraction decreases and the proportion of the low-viscosity fraction increases, and at the same time the viscosity of all the ppts. is decreased. Comparative study of the evolution, under the action of light, of collodions prep'd. from the several fractions obtained by fractional pptn. of a sample of commercial I showed that the evolution of the collodion prep'd. from the 1st fraction is slower than that of the collodion from any of the other fractions. In this connection, the following complementary observations were made: (1) rhodamine regularizes in all cases the evolution of collodion; moreover it noticeably retards the evolution of collodions obtained from the 2nd and 3rd ppts., but exerts no protective action on the collodion prep'd. from the 1st ppt.; (2) an Me_2CO soln. of I is a negative colloid, and the micelles of the collodion prep'd. from the 1st ppt. are the ones which move most rapidly under the effects of the elec. field. The behavior of rhodamine is explained as follows: addn. of rhodamine immediately increases the degree of dispersion quite considerably, but at the same time it retards the reduction in the degree of swelling of the granules; in other words, the Me_2CO -rhodamine system constitutes a new and excellent solvent of I because the latter is highly dispersed and highly swollen when dissolved in the mixt. There is a very decided relationship between the age of cellulose and the properties of the I which is obtained from it (cf. Meunier and B., *C. A.* **19**, 893). The size of the micelles in colloidal I sols. varies considerably, and in connection with each micelle must be considered the degree of polymerization and the degree of swelling, which depends on both concn. and temp. The smallest micelles, which are but slightly polymerized and slightly swollen, contain the simplest I mols.; while the large micelles, which are highly polymerized and highly swollen, contain the most complex I mols. The possibility of fractionating a given I, therefore, seems to depend, at least in part, on the presence, in the raw material used in its manuf., of a whole series of celluloses of different ages. Collodions and celluloid have a reticular structure; the lattice is made up of the large micelles; and the interstices are filled with a dispersion of the small micelles in the I solvent. In the products, the phenomena of aging, which are amplified under the action of heat, light or mechanical treatment, are explained by a disintegration of the lattice following upon the depolymerization and deswelling of the micelles; as the lattice becomes weaker, the phys. qualities of the products are partially destroyed. In order to avoid premature aging of collodions and celluloid, they should be prep'd. from I giving a large amt. of 1st ppt. on fractionation, or better still, they should be prep'd. from this 1st ppt. only. One of the chief impurities causing instability of I is H_2SO_4 , either absorbed or combined as nitrosulfuric esters. The product can be stabilized by neutralizing the acidity of these esters by prolonged washing with hard water (B. and Collin, *C. A.* **18**, 3715), but I thus stabilized is hardly suitable for the manuf. of collodion. The combined H_2SO_4 content of the ppts. obtained by fractionation of I decreases from the 1st to the last fraction: B. infers from this that, during nitration, H_2SO_4 esteri-

fies the secondary alc. groups of cellulose, and HNO_3 then reacts with the sulfuric esters; as the reactivity of the most highly polymerized mol. (which are the ones to be pptd. first in fractionation) is smaller than that of the least polymerized mol., the latter are more completely nitrated than the former. This accounts not only for the higher H_2SO_4 content of the 1st ppt., but also for the fact that this 1st fraction has a very slightly lower N content than the other fractions.

A. PAPINEAU-COUTURE

A new cellulose ester. P. ANIER. *Peintures, pigments, vernis* 4, 376-9(1927).—A brief outline of the properties of benzylcellulose and of the advantages of its application in the manuf. of varnishes and molded plastics.

A. PAPINEAU-COUTURE

Sulfur dioxide gas cleaning for sulfite liquor produced from pyrite. P. E. LANDOLT AND N. W. SULTZER. *Trans. Am. Inst. Chem. Eng.* 18, 223-30(1926).—A gas-cleaning system consisting of a spray tower and a Cottrell precipitator renders the SO_2 gas free from fine particles of pyrite and other materials or impurities, and makes it suitable for use in sulfite-liquor production. The economics of the case will det. the practicability of the use of pyrite fines and concentrates. The parts of the system are illustrated and some costs are given.

W. H. BOYNTON

A technical study of the commercial utility of tacuara cane and some agricultural wastes. A project for a cellulose factory. G. P. MAIDANA. *Anales asoc. quim. Argentina* 25, 73-104(1927).

E. M. SYMMES

Libyan esparto: its commercial utilization in Italy and problems relating thereto. CAMILLO LEVI. *Chimie et industrie* 18, 156-66, 338-49(1927).

A. P. C.

Alcohol as a by-product of paper manufacture. ANON. *Petroleum Times* 18, 366(1927).—The prepn. of alc. from the hexose sugars in the waste liquors arising in the paper-making industry by the method of Ekström consists in neutralizing the soln. with lime or limestone and pptg. CaSO_4 and CaSO_3 . The liquor is then cooled and fermented with beer yeast, and distd. The product may be used as motor fuel without further refining. For every ton of pulp produced, 8-10 cu. m. of liquor are made which yields about 1% of its vol. of alc.

M. B. HART

Chemical theory of the dyeing of cotton (BARY) 25. Recovering volatile solvents from air or gas mixtures [in the celluloid or artificial-silk industries] (Brit. pat. 262,404) 13. Preserving vegetable oils [for use in coatings for paper] (Brit. pat. 261,863) 27. Waterproofing paper (Brit. pat. 262,605) 25. Basic Cu sulfate (Can. pat. 271,782) 18. Filtering membranes (Brit. pat. 262,131) 18. Bleaching pulp (U. S. pat. 1,642,978) 18.

Cellulose compounds. L. LILIENFELD. U. S. 1,642,587, Sept. 13. A cellulose-xanthic acid is treated with a mono-halogen deriv. of a fatty acid as monochloroacetic acid to obtain a product which forms coatings, etc., insol. in H_2O . U. S. 1,642,588 specifies bringing a soln. of a cellulose-xantho-fatty acid in an aq. liquor into the form of films or threads or other desired artificial material and then effecting deposition of solid material from the soln., e. g., by drying. Cf. C. A. 20, 2411.

Cellulosic composition. E. E. REID. Can. 271,948. June 28, 1927. A compn. contains a cellulose ester and a Bu phthalate.

Cellulose ester. H. HEINMAN and A. BAYERL. Can. 273,515, Aug. 30, 1927. Cellulose to be esterified is subjected to a treatment with lactic acid of 80% strength.

Treating cellulosic materials with sulfuric acid and aliphatic acids. C. DREYFUS. Brit. 262,157, June 6, 1925. Cotton, cotton yarn, cotton fabrics, cotton paper, filter paper, wood cellulose, etc., are treated, with or without heating to substantially above ordinary room temp., with a mixt. of concd. H_2SO_4 and an aliphatic acid such as acetic, formic or propionic, together with not more than 5% H_2O which may be introduced with substances such as ZnCl_2 , Na_2SO_4 or $\text{Al}_2(\text{SO}_4)_3$ as H_2O of crystn. The material may be treated under tension and the acid subsequently removed by dil. NH_3 . After drying, the material may be pressed or calendered.

Alpha cellulose pulp. C. A. BLODGETT and H. H. HANSON. Can. 273,013, Aug. 9, 1927. Sulfite pulp is subjected to an aq. soln. contg. a reactive compd. of S in alk. soln., the sol. products of reaction being subsequently sepd. from the residual cellulosic solids.

Cellulosic capsules or other hollow articles. KALLE & Co. AKT.-Ges. Brit. 262,741, Dec. 14, 1925. Capsules such as those prepd. as described in Brit. 261,047 (C. A. 21, 3462) are given a metallic luster by adding to the starting material mica or mosaic gold or both.

Hydrolysis of cellulosic material. J. LEFRANC. Can. 273,538, Aug. 30, 1927. Finely powdered cellulosic material is mixed with an aq. soln. of a sulfuric compd. of an acid nature; the paste thus obtained is stirred while drying at 100-120° until the H_2O

content is reduced to about 50–60%. The acid substances present are neutralized and the sol. hydrolyzed products are livigisted.

Cellulose fiber. C. DREYFUS. Can. 273,366, Aug. 23, 1927. Material formed from an org. substitution deriv. of cellulose is treated with a soln. which is a swelling agent for the material and contains a metal salt. The material is subsequently treated with Na_2HPO_4 and Na_2SiO_3 to fix corresponding insol. salts in it.

Cellulose fiber. C. DREYFUS. Can. 273,367, Aug. 23, 1927. Material formed from an org. substitution deriv. of cellulose is treated with a soln., including $\text{C}_{10}\text{H}_{14}\text{O}_8$, which is a swelling agent for the material and acts to fix an insol. salt therein. The material is subsequently treated with tartar emetic to increase the effect of the first treatment.

Composition for stiffening and fireproofing cellulosic sheet materials. C. R. FELIX. U. S. 1,643,116, Sept. 20. A compn. suitable for treating paper or cloth is formed of 10% B_2O_3 , Na silicate soln. 1 qt., Na tungstate 46 g. and a stabilizing substance such as H_2BO_3 together with about 2 gals. of H_2O .

Wood pulp. I. G. FARBEINDUSTRIE AKT.-GES. Brit. 262,693, Sept. 17, 1926. In making bisulfite pulp, boiling is continued until no more bisulfite remains as indicated by the Sander test. After completion of the boiling, free SO_2 is blown and absorbed and none is allowed to escape during the boiling. The use of a mixt. of Ca and Mg bisulfites is preferred.

Pulping wood. F. G. RAWLING. Can. 271,900, June 28, 1927. Wood chips are submerged in and heated with an aq. soln. of a normal sulfite and a salt of a weakly ionized polybasic acid at a temp. of 100–125°, after which the chemical treating liquor is removed and the woody material is heated to a higher temp.

Material similar to vulcanized fiber. K. ZARFEL. Brit. 261,959, Feb. 15, 1926. A material suitable for use in stuffing boxes or as an elec.- or heat-insulating material is prepd. by boiling cellulosic fiber with NaOH in a closed vessel, sepg. the liquid, and washing, grinding and compressing the treated fiber.

Fertilizer from sulfite liquor. M. P. NITSCHKE. Can. 271,893, June 28, 1927. A fertilizer is produced from the waste liquors obtained in the manuf. of sulfite cellulose by first liberating the H_2SO_3 from the waste liquors by means of an acid sulfate, for instance, KHSO_4 and recovering the H_2SO_3 for carrying on the process.

Viscose material. J. VOSS and O. SCHNECKO. Can. 271,593, June 14, 1927. Non-transparent, hollow bodies of viscose, which dry up with a glossy surface, are made by dipping the cellulose bodies first into a bath of BaCl_2 and then into a bath contg. a sulfate.

Viscose product. L. LILIENFELD. Can. 272,611, July 26, 1927. Viscose is acted upon with H_2SO_4 contg. at least 55% of $\text{H}_2\text{SO}_4 \cdot \text{H}_2\text{O}$. Can. 272,612 specifies 45–55% $\text{H}_2\text{SO}_4 \cdot \text{H}_2\text{O}$.

Viscose threads. W. H. GLOVER and G. S. HEAVEN. Can. 271,955, June 28, 1927. In the production of viscose artificial threads or filaments, a viscose is used which contains a small proportion of a high-boiling non-solid petroleum substance.

Artificial silk. H. SCHMIDT. Can. 272,495, July 19, 1927. Artificial silk, bands, etc., are manufd. by spinning threads or bringing bands, ribbons, etc., of $\text{CuO} \cdot \text{NH}_3$ -cellulose solns. made from wood pulp, straw, etc., into a bath at a temp. below 30°.

Apparatus for making filaments of artificial silk. BRYLSILKA, LTD. and F. W. SCHUBERT. Brit. 262,369, Aug. 4, 1925. H_2O or other liquid used in the manuf. of artificial silk is cooled and deaerated by vacuum treatment. Cf. C. A. 21, 3129.

Artificial threads. S. A. NEIDICH. U. S. 1,643,080, Sept. 20. A colloid filament is formed by extrusion of a compn. with more than 8% hydrated cellulose, into an aq. coagulating medium contg. H_2SO_4 and of at least 50% greater acidity than usually employed for producing solid filaments; each portion of the filament is allowed to remain submerged in the bath until its exterior is coagulated to form a skin and reversion and termination of moisture from the colloid are continued until the core mass within the skin sep. from the latter and forms a distinct filament and the skin forms a continuous cellular sheath sepd. from but coaxial with the core.

Spinning artificial silk. H. P. BASSETT and T. F. BANIGAN. U. S. 1,642,290–1, Sept. 13. Mech. features.

Paper and paper boards. G. F. BLOMBERRY. Can. 271,472, June 14, 1927. A film of liquid dope constituted of rubber suspended in a slurry of colloidal clay is applied to paper or paper boards.

Paper-making apparatus. N. J. NIKS. U. S. 1,641,986–7, Sept. 13.

Crinkling paper. E. H. ANGER. U. S. 1,643,147, Sept. 20. Mech. features.

Apparatus for pulping and deinking waste paper. O. C. WINSTOCK. Brit. 262,-270, Dec. 10, 1925.

Forming paper from asbestos fiber. J. A. HEANY. U. S. 1,642,495, Sept. 13. Mech. features.

Removable lining shell for Jordan engines. A. L. BOLTON. U. S. 1,642,327, Sept. 13.

24—EXPLOSIVES AND EXPLOSIONS

CHARLES E. MUNROE

A new and direct method of testing detonators. LOTHAR WÜHLER. *Z. ges. Schiess-Sprengstoffw.* 20, 145-50, 165 9(1926), 21, 1-5, 35 8, 55-7, 97-9, 121-3(1927).—The method was designed as a simple lab. method for detg. the initiating power of detonators by direct test on a series of samples of a standard explosive desensitized to different degrees. Practical tests of about 5000 detonators showed the method to be uniform and exact. The standard explosive used is TNT carefully recrystallized from a mixt. of 90% EtOH (d. 0.815) and 10% C₆H₆ (d. 0.880) by an exactly prescribed method, washed with solvent, dried and screened, and that portion retained which passes a sieve with 0.85-mm. openings and remaining on a sieve with 0.50-mm. openings. Fifty-g. portions are treated with varying amounts of paraffin oil (d₁₅ 0.890, viscosity 32.1 Engler at 16.4°) in Et₂O soln., the mixt. is thoroughly incorporated and the Et₂O evapd. at 50° with frequent stirring. The paraffin-oil content of the series of TNT samples varies from 1 to 8.75% in 0.25% increments. Uniform crystal size is important since with equal amounts of oil the smaller surface of coarse crystals carries a thicker layer of oil, which results in greater desensitization. This was definitely shown by tests. Two g. of the desensitized TNT is pressed at 100 kg. per sq. cm. in a Cu shell 10 mm. diam × 55 mm. deep, having walls 0.15 mm. and base 0.5 mm. thick. A cavity of proper diam. to receive the detonator to be tested is pressed in the center of the TNT so that the detonator charge is completely embedded in the TNT. The outer shell is placed upright on a Pb plate 40 × 40 × 5 mm., which is weighed before and after the detonator is fired. The wt. of Pb struck out of the plate is detd. in a series of tests on TNT with increasing content of paraffin oil, until a sharp break in the plotted curve of results shows that complete detonation of the TNT no longer occurs. The tests are made at a temp. of about 10°. The min. oil content which permits complete detonation is a measure of the initiating action of the detonator. More than 9% of the desensitizing oil cannot be used as it will exude on pressing the TNT. Where detonators of high brisance demand an explosive of greater insensitiveness, recrystallized trinitroxylenes treated in a similar manner with paraffin oil is used instead of the TNT mixts. The latter are suitable for testing all commercial detonators up to and including No. 8 size. Many tests were made on specially loaded detonators of various types. The use of a detonator shell with deeply indented base does not give an increased initiating effect on the explosive to be detonated, even though such detonators show greater perforating effect when tested directly on a lead plate. Pressing of detonator charges, particularly tetryl and tetranitropentaerythrite, at high pressures (up to 2000 kg. per sq. cm.) gives increased initiating effect. In a comparison of commercial No. 8 detonators, one type charged with 0.9 g. TNT and 0.5 g. Hg(ONC)₂ was compared with another containing 0.85 g. tetryl and 0.3 g. PbN₆-Pb trinitroresorcinate mixt. The former showed an initiating action corresponding to 6.5% paraffin oil as against 9% for the latter.

C. G. STORM

The reliability of methods employed for the measurement of the initiating effect of detonators. M. SUCHAREVSKII. *Der Krieg und die Technik* 1926; *Z. ges. Schiess-Sprengstoffw.* 22, 17.—Commercial and military detonators of various types, made in different countries, were studied to det. the effect of storage in moist air for 45 days, storage in water for 25 days, and heating at 50° for 100 hrs. (8 hrs. per day). Tests made included the sand test, lead-plate test, mail test, Trauzl test, and a test based on Hess's method using TNT desensitized with varying amounts of paraffin oil. S. concludes that (1) Hg(ONC)₂ detonators suffer very little from exposure to moisture, and even from immersion in water, if dried before use; (2) PbN₆-TNT detonators should not be loaded in Cu shells, as the Cu is seriously attacked on exposure to moisture, resulting in 75% failures; (3) PbN₆-TNT or PbN₆-tetryl detonators without trinitroresorcinate are ignited only with difficulty; (4) the use of an inner capsule increases the efficiency of fulminate detonators, as does also a concave depression 5 mm. deep

in the base of the shell; (5) fulminate-tetryl detonators showed the greatest resistance to the effects of moisture and of storage at 50°; (6) the use of an Al shell increases the efficiency of detonators, probably as a result of the heat of combustion of the Al; (7) PbN_6 -TNT (or tetryl) detonators seem to have no marked advantage over fulminate detonators, but the addn. of trinitroresorcinate to the former offers promise; (8) no conclusion can be reached as to the most suitable method for detg. the efficiency of detonators. S. notes numerous objections to the method of Wöhler (preceding abstract), and proposes a method in which the detonators to be tested are used to initiate the explosion of TNT desensitized with from 1 to 5% of paraffin oil and pressed in blocks 31 mm. diam \times 41 mm. high, the effect of the charge in compressing Pb cylinders being noted.

C. G. STORM

A new and direct method of testing detonators by Lothar Wöhler. M. LUPUS. *Z. ges. Schiess-Sprengstoffw.* 21, 213-5, 221-2 (1926).—Controversial (cf. second preceding abstract).

C. G. STORM

The importance of explosives manufacture. PAUL PASCAL. *Army Ordnance* 8, 103 (1927).—An abstract of a review of the explosives industry in France during the war, when 1,200,000 tons of explosives and 300,000 tons of smokeless powder were manufd.

CHARLES E. MUNROE

Fundamental properties of military high explosives. G. C. HALE. *Army Ordnance* 8, 115-6 (1927).—A statement of the properties desired, the reasons why and exptl. means for their ascertainment.

CHARLES E. MUNROE

Explosive ammonium salts. H. KAST. *Z. ges. Schiess-Sprengstoffw.* 21, 205-9 (1926); 22, 6-9, 30-4, 56-61, 77-80, 99-102, 131-5 (1927).—A summary is given of the literature on the formation and properties of NH_4 azide, nitrite, nitrate, chlorate, perchlorate, permanganate, dichromate and trichromate. Values are given for the heats of formation and explosion, explosion temp., sp. energy, detonation velocity, brisance and sensitiveness to shock, friction and heat. For NH_4NO_3 complete detonation could not be obtained, nor could a definite detonation velocity be found by either the chronographic or Dautriche methods. With mixts. of NH_4NO_3 and $(\text{NH}_4)_2\text{SO}_4$ the detonation velocity varied with the cu. d. of the charge, being, for the 60/40 mixt., 1900 and 2430 m./sec. for cu. densities of 0.88 and 0.90, and, for the 70/30 mixt., 2600 and 2860 m./sec. for cu. densities of 0.76 and 0.87. NH_4ClO_4 is not so hygroscopic as the nitrate, but more hygroscopic than KClO_3 . NH_4ClO_4 is more stable in hot storage than NH_4NO_3 , and the decompn. is hastened by the presence of the oxy-chlorine decompn. products. Comparative data are given for the ignition points of KClO_3 and NH_4ClO_4 and NH_4NO_3 , alone and in the presence of certain hydrocarbons, metals, metallic compds. and combustible organic compds. Mixts. of KMnO_4 and NH_4NO_3 may interact to form the very sensitive and explosive NH_4MnO_4 . No definite dividing line can be drawn between explosive and non-explosive mixts. of NH_4NO_3 with other ammonium or alkali salts, as the mode of ignition, degree of confinement, and size of grain are important factors. The use of blasting to break up mixts. of NH_4 salts that have set hard is deprecated.

B. C. A.

Calculation of the "force" and some other essential constants of explosives. NORIHI YAMAGA. *J. Faculty Eng., Tokyo Imp. Univ.* 17, 79-88 (1927); cf. *C. A.* 19, 1630.—With a knowledge of the compn. of the powder and the heats of formation of its constituents, the characteristic consts., such as "force," explosion temp., and sp. vols. of evolved gases, can be calcd. by solving graphically the following 3 equations: $K = [\text{CO}] \cdot [\text{H}_2\text{O}] \cdot [\text{CO}_2] \cdot [\text{H}_2] = (A_c - x) (A_o - A_c - x) / x [A_h - (A_o - A_c - x)]$, $Q_o = 10,110x + A_o q_{o0}$, $(A_o - A_c) q_{H_2O} - q = \int x (C_{CO_2} - C_w - C_d + C_h) + (A_o - A_c) C_w + (A_c + A_h) - (A_h - A_o + A_c) C_h dT$, where C_{CO_2} , C_w , C_h and C_d = sp. heats of CO_2 , H_2O , H_2 and diatomic gases other than H_2 , resp.; A_c , A_o , $2A_h$ and $2A_d$ = at. percentages of C, O, N and H, resp.; x = no. of mols. of CO_2 in the explosion gas; Q = heat of explosion of the powder; and q = heat of formation of the powder. This paper presents graphically the results obtained in the application of these formulas to (1) smokeless powders contg. various percentages of nitroglycerin and volatile matters, (2) smokeless powders of nitrocellulose contg. various percentages of volatile matters and diphenylamine, and (3) nitrocellulose contg. various percentages of N.

CHARLES E. MUNROE

Supposed law of flame speeds. A. G. WHITE. *Nature* 119, 674 (1927).—A reply to letters received from W. Payman and R. V. Wheeler (cf. *C. A.* 21, 2560). J. W. S.

Study of instantaneous evolution of fire-damp. E. LEMAIRE. *Ann. mines Belgique* 27, 849-60 (1927); *Chimie et industrie* 18, 228 (1927).—From a discussion of the explosion theory (Stassart and Lemaire, *Ann. mines Belgique* 15 (1910), CH_4 or CO_2 present as such in the pores of the coal) and of the pressure in the seam theory (originally due to Morin, according to which the evolution of the gas is primarily due to the

orogenic tension of the formation) L. considers that the 2 theories can be conciliated and are not mutually exclusive. According to L. instantaneous evolution of gas from coal may be due to permanent or momentary gas tensions, and particularly: (1) to the amt. of gas contained in the seam (free, dissolved or adsorbed); (2) to the resistance of the seam to total or partial disintegration; (3) to the difference between the resistance of the seam to disintegration and the permanent or momentary gas tension to which it is subjected.

A. PAPINEAU-COUTURE

The Acton bitumen fumes explosion. ANON. *Gas J.* 179, 505-6(1927).—A short-circuited elec. feeder caused the gasification of bitumen in which it was embedded. This gas found its way along a service cable into a nearby shop, forming an explosive mixt. which was ignited in some way and wrecked the shop.

R. W. RYAN

Fire hazards from hydrogen peroxide solution of high concentration. G. AGDE AND E. ALBERTI. *Z. angew. Chem.* 40, 949(1927); cf. *C. A.* 20, 3815.—Expert opinion now reserves the term "high concn. solu. of H_2O_2 " for solns. contg. 45% or more H_2O_2 . The 30% soln. ought not to be so designated. It is preferable to give the actual % of H_2O_2 present.

W. C. EBAUGH

A primer on lacquer spraying (MILNE) 26. Fire fighting in oil refineries (EPPS) 22.

Explosives. A. C. SCOTT. *Brit.* 262,491, Aug. 12, 1925. Explosive cartridges are formed with a charge of $KClO_3$ or $KClO_4$ or NH_4NO_3 , compressed and impregnated with a nitro compd. such as $PhNO_2$, trinitrobenzene, mononitrotoluene, dinitrotoluene, trinitrotoluene, trinitroxylene or picric acid, the distribution of which in the charge may be assisted by addn. of kerosene or other mineral oils (which may have an asphalt base) and xylene. Desensitizing oils such as castor or linseed oil, liquid paraffin, wool fat, or lanolin and "cooling agents" such as nitrates or oxalates or chloride of Na, K and NH_4 may be added (but no NH_4 salt should be used together with a chlorate). Cf. *C. A.* 21, 652.

Preventing explosions in mines. W. E. TRENT. U. S. 1,642,912, Sept. 20. Mine surfaces are treated, for entrapping and retaining coal dust, with a hydrocarbon oil of high b. p. and high flash point.

Blasting cartridge. P. T. McLAUGHLIN and W. ANDERSON. U. S. 1,642,341, Sept. 13. Structural features.

25—DYES AND TEXTILE CHEMISTRY

L. A. OLNEY

Reports of research work on the fastness to light of dyestuffs on woolen and worsted fabrics. Introductory note. The British Research Association for Woolen and Worsted Industries. *J. Soc. Dyers Colourists* 43, 253-4(1927).—This paper has been divided into 10 sections so that each piece of work might be given its true significance. I. Comparison of the fading of dyestuffs in tropical and in English sunlight and by artificial light. S. G. BARKER AND H. R. HIRST. *Ibid* 254-61.—The tests show that the present system of artificial fading does not agree in results with those obtained from sunlight, and that there was actually less fading in the tropics than at country stations in England. This discrepancy is attributed to the greater humidity in England. II. Atmospheric humidity and the fading of dyestuffs. J. J. HEDGES. *Ibid* 261-2.—Increase of color loss with increase of humidity is an important variable in fading conditions. It is essential therefore to prescribe a standard humidity for all fading tests. III. Relation between time of exposure and loss of color due to fading. S. G. BARKER, H. R. HIRST AND P. N. LAMBERT. *Ibid* 263-4.—Under standard conditions the loss of color has a direct relationship to the time of exposure. This relation is not linear as color loss in the earlier stages is more rapid than later. In standardization of color fastness sufficient time should be given to the exposure to allow the fading to be in excess of the initial more rapid fading action. IV. Relation between initial depth of shade and loss of color due to fading. *Ibid* 264-6.—The total color loss is the same for all shades; therefore this loss is a much higher percentage of the total color in the pale than in the deep shades. This explains the statement that deep shades are faster than pale shades. V. Effect of ultra-violet radiation on the fading of dyed fabrics. LEONARD HILL. *Ibid* 266-7.—Increased fading occurred with increase of the quantity of ultra-violet radiation both from the point of view of percentage transmitted and the distance further down the spectrum into the ultra-violet region. Moisture increases the fading. For the results to be comparable

with sunlight fading, any artificial fading lamp must transmit to the pattern only such radiation in the ultra-violet as exists in the solar spectrum. Vitaglass is a good filter for this purpose. VI. Transmission of sunlight through glass and its effect on fading of dyestuffs. I. O. GRIFFITH AND R. C. G. JENKINS. *Ibid* 297-9.—Plate glass windows cut out a large amt. of the ultra-violet and almost entirely the far ultra-violet from sunlight, and decrease the luminous portion of the spectrum by at least 10%. Apparent increase in fading power behind glass in some cases is due to other causes, *viz.*, humidity and atm. conditions. Vitaglass stops very little of the solar spectrum and justifies its use in the new fading lamp for rapid tests. Quartz is translucent to all solar radiations, but is costly and difficult to obtain in large even sheets. VII. Radiation from gas-filled electric lamps. GEN. ELEC. CO.'S RESEARCH LAB., LONDON. *Ibid* 299-300.—Radiation from gas-filled lamps for shop lighting carries almost no ultra-violet rays and therefore would cause less fading than direct sunlight. VIII. An exposure cabinet for outdoor fading tests. S. G. BARKER AND H. R. HIRST. *Ibid* 300-1.—A cabinet is described which protects the patterns from dirt, soot and rain. The transparent protective screen in front of the patterns should be of vitaglass which admits the entire solar spectrum. IX. Humidity and temperature tables. *Ibid* 301-2.—These tables give the av. relative humidity and av. temp. for each month in over 50 cities representing all continents. X. The guild trichromatic colorimeter. J. PERRY. *Ibid* 159; cf. C. A. 21, 2079. L. W. RIGGS

Fastness to rubbing and washing of Naphthol AS dyes. W. ROIGER. *Z. ges. Textil. Ind.* 1925, 654; *Melliands' Textilber.* 7, 787(1926).—The fastness to rubbing and washing shown of Naphthol AS dyes (cf. Kielbasinski, C. A. 21, 2987) is improved most satisfactorily by completely removing excess of the naphthol soln. from the surface of the textile material before coupling with the diazotized base, but improvement may also be effected by the addn. of 2-4% of Verapal or 0.2-0.4% (calcd. on the wt. of soln.) of Cycloran to the soap and soda soln. used for soaping the dyed material. The addn. of tannic acid has a similar effect but darkens the resulting shade. B. C. A.

Practical hints on the production of bright colors on textile fabrics. XXIX-XXXII. RAFFAELE SANSONE. *Am. Dyestuff Rept.* 16, 408-10, 419-20, 445-50, 479-80, 532-5 (1927); cf. C. A. 21, 2800.—These papers are mainly descriptions of plants, machinery and factory processes. L. W. RIGGS

Discussion of some (modern) tinctorial processes. MARCEL BADER. *Rev. chim. ind.* 36, 182-90(1927).—Discussion and explanation of the reactions involved in dyeing by means of ice colors and vat dyes. A. PAPINEAU-COUTURE

Is digallic acid as a mordant for basic dyes identical with tannin? P. P. VIKTOROV. *Z. angew. Chem.* 40, 922-5(1927); cf. C. A. 21, 824.—Comparative expts. were made on the mordant action of tannin and digallic acid. It was found that *m*-digallic acid (prepd. according to Fischer) is absorbed by cotton (3 g.) in 1% soln. (50 cc.) to an extent of from 16.2 to 19.2% of the initial amt. present in 1/2 up to 24 hrs. Tannin absorption by cotton appears from the literature also to increase with time. Comparative dyeing expts. with both substances using a variety of basic dyes (1% soln. of mor. ant., 0.125% dye of fiber weight for 1/2 hr., fixation with 0.5% tartar emetic) gave closely parallel results. It is concluded that the tannin action is due to the digallic acid liberated from this substance. This conclusion is substantiated by a recalcn. of data of Sanin (*Ber. Ges. Ford. d. Text. Ind. Moskau* 1908 and 1909) on the relative amts. of tannin and tartar emetic used in dyeing. The possible mordant action of Turkish tannin, pentagalloyl- β -glucose, as compared with Chinese and Japanese tannin (pentadigalloyl- β -glucoses), an open question. B. J. C. VAN DER HOEFEN

Dyeing cotton-wool and cotton-silk mixtures with Sirius colors. PAUL RABE. *Melliands' Textilber.* 8, 693-4(1927).—The special fastness of the Sirius colors adds to their desirability for union dyeing. At the boil, Sirius Yellow 5G, GG and G, Red BB and 4B, Rubin R, Bordeaux 5B and Brown GR dye wool and cotton evenly, while wool is dyed less than cotton by Yellow R, RR and T, Orange 5G, G and GR, Scarlet B, Rubin B, Rose BB and G, Red Violet R and B, Blue B, 6G, BRR and G, Brown G, GR and R and Grey G and R. For two bath union styles, certain Sirius colors have practically no affinity for wool. These may with advantage be applied at 20-30° with the addn. of Na₂SO₄ and Na₂CO₃, or at 50-70° with 2 to 3% Katanol W. For silk unions, soap and Na₂CO₃ restrain the affinity for the silk and temps. of 60-70° are possible. In one bath work on half-silk, level baths are obtainable with Sirius Yellow 5G, GG and G, Rubin R, Violet BL, Red BB and 4B, Red Violet BBL and Brown G and GR. E. R. CLARK

Use of Neolan colors in wool and silk printing. H. BERNHARD. *Melliands' Textilber.* 8, 699-702(1927).—The Neolan dyestuffs are Cr derivs. of *o*-oxyazo colors. Ap-

plied to wool from strongly acid baths, they yield fast shades, superior in brightness to those obtainable from the Cr mordant dyes. Silk, differing from wool, is advantageously dyed with these products from baths acidified with HCOOH or AcOH rather than with H_2SO_4 . Weighted and unweighted silk are dyed to the same depth, and silk dyed with the Neolan colors does not lose luster and handle as when Cr mordanted. These properties make fast prints on silk more practical than heretofore. Discharge styles are produced with $\text{Na}_2\text{S}_2\text{O}_4 + \text{HCOOH}$ prepns. Illustrative samples are affixed. E. R. C.

Palatine fast colors for wool-dyeing. J. NUSSLEIN. *Melliands' Textilber.* 8, 708-9 (1927).—This (cf. preceding abstr.) is another series of fast wool colors dyed in strongly acid baths (8-10% H_2SO_4), showing the properties of the Cr mordant dyes without the faults due to mordanting. Samples are affixed. E. R. CLARK

Colored naphthol AS discharges. F. STRENG. *Melliands' Textilber.* 8, 708-9 (1927).—The discharging of a dyeing made with a Naphthol AS-D ground coupled with Fast Red KB Base, with Rongalit and Indanthrene Golden Orange GK is typical of many possibilities. Several such combinations are illustrated by samples. E. R. CLARK

Chroming of wool and silk by steaming. Dyeing in colors with chroming. JOS. POKORNY. *Rev. gén. mat. color.* 31, 212-5, 249-52 (1927); cf. *C. A.* 17, 212.—The author's paper of 1921 is reviewed and applications of the alkali chrome mordant to the dyeing of cotton are described. Specifications from sealed notes are quoted showing the application of the chromate method and steaming to the dyeing of wool and silk. The present paper is largely a plea for the practicability of the method and for the author's priority. L. W. RIGGS

The "soluble vat" dyestuffs on acetate silk. C. E. MULLIN. *Am. Dyestuff Rept.* 16, 575-8 (1927).—A description is given of these dyestuffs with formulas and methods used in dyeing and printing acetate silk and cotton-acetate silk union materials. Six methods for handling these dyestuffs are described in detail. L. W. RIGGS

Bleaching and dyeing knit goods without detriment to their structure. GEORGE RICE. *Am. Dyestuff Rept.* 16, 578-9 (1927). L. W. RIGGS

Function of enzymes in bleaching and dyeing. GEORGE RICE. *Am. Dyestuff Rept.* 16, 555-6 (1927).—The topics discussed are the soln. of starch and gums by aid of enzymes, rapidity of action, production of "diastase" and "polyzyme," and the mech. operation of the goods during enzyme treatment. L. W. RIGGS

Bleaching with hydrogen peroxide. H. G. SMOLENS. *Am. Dyestuff Rept.* 16, 545-9 (1927).—Seven specifications of H_2O_2 for bleaching purposes are stated. Since H_2O_2 may act as a reducing agent in acid solns. and thereby cause many undesirable reactions to the injury of the goods, it is necessary that the bath be kept continuously alk. Five specifications of the alkali are given, the choice of alkali depending to some extent on the acids present with the H_2O_2 . During bleaching the bath must be controlled from time to time so that the alkali does not combine chemically or act physically on the material being bleached. Directions are given for the avoidance of underbleaching, overbleaching, harshness and spoilage. L. W. RIGGS

Bleaching straw for braids. SHUMPU UTAKE. *Repts. Imp. Ind. Research Inst. Osaka, Japan* 7, No. 11, 1-27 (1927).—Various reagents and factors in bleaching straw for braids have been studied in detail and optimum conditions for each reagent detd. NAO UYEI

Chemical theory of the dyeing of cotton. PAUL BARY. *Tiba* 5, 847-53 (1927).—Cellulose is essentially amphoteric, possessing OH groups replaceable by acid radicals (formation of cellulose esters) and H atoms replaceable by metals (formation of alkali celluloses). In strongly acid medium cellulose has a tendency to give off OH^- and acquire a + charge; in alk. (or weakly acid) medium it has a tendency to give off H^+ and acquire a - charge. As the isoelec. pt. of cellulose is at a fairly low p_{H} , it forms esters more readily than alkali celluloses. Most of the cotton dyes are substantive (e. g., Congo red) and form collo-electrolytic solns., i. e., though they are crystn., their solns. contain undissoc. micellas of the type $(\text{Na}_2\text{R})_n$, the same micellas dissoed. into negative granules and Na^+ , simple undissoc. mol. of the type Na_2R , and the same mol. dissoed. into R^- and Na^+ . The dyeing of cotton is attributed to a combination between the dye and the fiber, as for wool and silk, but differs from the latter in 2 particulars: (1) the isoelec. pt. of cellulose is such that it combines more readily with acids than with alkalies; (2) the dyes which can be fixed by cotton consist almost exclusively of compds. contg. numerous acid radicals, giving rise to complex soly. phenomena with simultaneous presence of dissoed. and undissoc. simple and polymerized mols., each class having a different electrolytic dissoen. coeff., which varies with temp., concn., etc. This latter property accounts for the fact that the amt. of dye fixed is not proportional to

the mol. wt. of the dye (since the true mol. wt. of the solid cryst. dye is unknown), and that complete exhaustion of the bath cannot be obtained. A. PAPINEAU-COUTURE

Spontaneous production of a pink coloration on bleached cotton. J. PINTÉ. *Tiba* 5, 863(1927); cf. C. A. 21, 2066.—Cotton bleached with $\text{KMnO}_4\text{-Na}_2\text{SO}_3\text{-Na}_2\text{O}_2$ turns pink, as does that bleached with hypochlorites, though to a less extent but only in the presence of traces of acid, particularly formic acid. A. PAPINEAU-COUTURE

Bleaching and dyeing of viscose stockings with cotton tops, toes and heels. P. CUYVELEY. *Tiba* 5, 973-9(1927).—Detailed description of the technic to be followed together with a no. of dyeing formulas. A. PAPINEAU-COUTURE

Preparation of raw materials for the manufacture of brushes, etc. BORSTER-BRISTLE. *Tiba* 4, 1047, 1049, 1307-17, 1437-47(1926); 5, 27-33, 301-5, 565-9, 823-5(1927).—A detailed description of the chem. treatments of hog bristles, etc.

A. PAPINEAU-COUTURE

The physicist and wool fiber. H. A. GOODMAN. *Am. Dyestuff Rept.* 16, 579-80(1927).—A review of the work of Speakman and others. L. W. RIGGS

Specific action of the various acids on wool. C. E. MULLIN. *Am. Dyestuff Rept.* 16, 515 20, 550-4(1927); cf. C. A. 21, 499.—A review of the sp. action of H_2SO_4 , HCl , H_3PO_4 , HNO_3 , H_2CrO_4 , HOAc and $\text{C}_{14}\text{H}_{10}\text{O}_4$ on wool fiber. Tables of ionization consts. of the various acids at different temps. are quoted, and the amt. of acid combined with wool at various H-ion concns. is shown. L. W. RIGGS

The chemical analysis of cotton. Action of hot dilute sodium hydroxide solutions on modified cotton cellulose. D. A. CLIBBENS, ARTHUR GEAKE AND B. P. RIDGE. *J. Textile Inst.* 18, 277-87T(1927); cf. C. A. 21, 2192.—Oxycelluloses suffer a fall of viscosity in cuprammonium solns. when boiled 6 hrs. in 1% NaOH soln., and differ in this respect from hydrocelluloses and normal-bleached cotton. The amt. of viscosity change varies with the manner in which the oxycellulose is formed but is very great for neutral hypochlorite oxycelluloses, the most frequently occurring type of technically oxidized cotton. An exactly similar behavior is observed when the alkali boil is replaced by treatment used in the detn. of the Cu number (Braid's method). This test for the nature of modification may be made by comparing the viscosity of a sample of cotton with that of the material remaining after the detn. of its Cu no. The enhanced Cu nos. of modified celluloses are reduced on the av. to $1/3$ of their original value as a result of 6 hrs. treatment with boiling 1% NaOH under atm. pressure, and to about 0.1 by a similar treatment at 20 lbs. per sq. in. excess of pressure. Generally methylene blue absorption of modified cellulose rises in consequence of alkali boiling. This rise appears to be connected with the concurrent fall of Cu no. The percentage loss of wt. by modified cottons on boiling 4 hrs. with 1% NaOH at ordinary pressure is about 6 times the Cu no. when the latter does not exceed 2.5. For modification which results in a Cu no. greater than 2.5, hydrocelluloses experience a greater and oxycelluloses a smaller loss of wt. than corresponds with this relation, and the divergence increases with increasing cellulose modification. L. W. RIGGS

Hygroscopic properties of cotton and its charred products. S. V. GORBACHEV AND E. N. VINOGRADOVA. *Biochem. Z.* 186, 413-8(1927). S. MORGULIS

The sizing of textiles. G. BRUGÈRE. *Russa* 2, 687-91(1927).—Brief discussion of the function of sizing of textiles, particularly viscose and silk yarn, and of the relative merits of dry and aq. sizes, with an outline of the proper method of carrying out the operation. A. PAPINEAU-COUTURE

Desizing with activin. RICHARD FEIBELMANN. *Melliands' Textilber.* 8, 714-5(1927).—According to the recommended method, a soln. contg. 0.2 to 0.3% each, on the weight of cloth, of activin and Na_2CO_3 is circulated through the cloth while maintained at 80° . Colored yarns in bleach fabrics are not affected, and tensile variations parallel those experienced in the more common forms of desizing treatments. E. R. COOLEY

Balancing process steam and power in a coated-fabric plant. L. C. COOLEY. *Chem. Met. Eng.* 34, 551-3(1927). E. H.

Coated textiles. HAMILTON BRADSHAW. *Ind. Eng. Chem.* 19, 1109-10(1927).—The three principal types of coated textiles are the pyroxylin, or so-called "artificial leather," the linseed oil and the rubber-coated fabrics. The chem. problems involved in the industry and its important contributions to the present-day automobile are discussed. RUBY K. WORNER

Mothproofing fabrics and furs. A consideration of the procedures that have been proposed by others and a description of a new process. L. E. JACKSON AND HELEN E. W. GERRARD. *Ind. Eng. Chem.* 19, 1175-80(1927).—A report of the work carried on under the Multiple Industrial Fellowship established by the Mundaetchnical Society of America at the Mellon Institute of Industrial Research. Of the chemicals and mixts. of chem-

icals studied, only the cinchona alkaloids and their derivs. have the following necessary properties for effective clothes-moth repellents: They are inodorous, adhere evenly and can be put on like dyestuff, are unnoticeable, do not dust off, do not affect adversely the phys. properties of the fiber, can be made sol. in inexpensive org. solvents as well as in H_2O , are non-toxic to human beings, are excellent clothes-moth repellents, and are economical to use industrially.

Phormium tenax (New Zealand flax). P. DE SORNAY. *Rev. agr. Maurice* 4, 55 (1927).—A brief outline of cultural practices and the prepn. of fiber from this plant is presented. It could probably be grown profitably in Mauritius. RUBY K. WORNER F. W. ZERBAN

Anthraquinone derivatives (Brit. pat. 262,119) 10. Preserving vegetable oils [for use in coatings for fabrics] (Brit. pat. 261,863) 27. Composite yarns of ramie or rhea and artificial silk (Brit. pat. 262,256) 30. Bleaching pulp or other fibrous material (U. S. pat. 1,642,978) 18. Composition for stiffening and fireproofing cellulosic sheet materials (U. S. pat. 1,643,116) 23.

PANNIZON, GIACOMO: Guido per il tintore moderno. Milan, 1927: Ulrico Hoepli. 706 pp. 32 lira. Reviewed in *Rev. prod. chim.* 30, 570(1927).

Dyes. I. G. FARBENINDUSTRIE AKT.-GES. Brit. 262,457, Dec. 4, 1925. Thio-indigoid dyes are prep'd. by condensing 4,5,6,7-tetrahalogen-3-hydroxy-1-thionaphthene with a cyclic α -diketone such as isatin, 2,3-diketodihydrothionaphthene or a substitution product or reactive α -deriv. The products may be further halogenated. They dye cotton from the vat violet to brown shades.

Dyes. I. G. FARBENINDUSTRIE AKT.-GES. Brit. 261,769, Nov. 19, 1925. Azo dyes are made by coupling a diazo component with a coupling component, at least 1 of the components contg. 1 or more carboxylic ester groups (excepting the dyes described in Brit. pat. 243,758 (C. A. 21, 179) and in Brit. pat. 256,272 (C. A. 21, 2989) and those obtained by coupling diazo salts of aminobenzoic ester with 1,8-hydroxynaphthalene-4,6-disulfonic acid and by coupling diazo salts of anthranilic ester with β -naphthol. The dyes may also be made by esterifying the free COOH group or groups in finished azo dyes contg. such groups. Numerous examples are given and dyes may be obtained, from different components, suitable for pigments, or for dyeing wool, silk or cellulose acetate, or having the character of substantive dyes.

Dyes. I. G. FARBENINDUSTRIE AKT.-GES. Brit. 261,770, Nov. 19, 1925. Azo dyes suitable for dyeing fibers of all kinds and for use in making lakes are made by coupling a diazo comp'd. with a 1-(4'-chloro-5'-methyl-2'-sulfo-) phenyl-5-pyrazolone, in which the 3-position is substituted by a methyl, carboxylic or carboxylic ester group. Several examples are given. The pyrazolones used may be obtained by condensing the corresponding hydrazine with an ester of acetoacetic or oxaloacetic acid (employing a mild non-sapon. agent such as Na_2CO_3 when the carboxylic esters are desired).

Dyes. I. G. FARBENINDUSTRIE AKT.-GES. Brit. 262,141, Nov. 28, 1925. Thiazole derivs. of 1,4-naphthoquinone are obtained by condensing 2-amino-3-mercapto-1,4-naphthoquinone with an aldehyde such as benzaldehyde, glyoxal, 1-naphthaldehyde, *or*-tetrahydronaphthalene-1-aldehyde, 4-aminobenzaldehyde, 4-dimethylaminobenzaldehyde, 2-chloro-4-dimethylaminobenzaldehyde or terephthalic aldehyde. The intermediate products first obtained pass into thiazoles by the action of atm. O and may be used directly for vat dyeing. 2-Amino-3-mercapto-1,4-naphthoquinone is obtained by treating 2-amino-3-chloro-1,4-naphthoquinone with Na sulfide.

Dyes. BADISCHE ANILIN & SODA FABRIK. Brit. 262,030, Oct. 9, 1925. Isodibenzanthrone dyes are obtained by treating Bz 1-chloro- or Bz 1-bromo-benzanthrone or other Bz 1-halogen benzanthrone having a free 2-position with metal arylides such as K anilide or Na anilide and Me anilide. Examples are given for the production of dyes giving violet shades on cotton. Directions for prepg. the starting materials are given.

Dyes. SOC. ANON. POUR L'IND. CHIM. A BALZ. Brit. 262,774, Dec. 8, 1925. Violanthrone is chlorinated at temps. above 80° in the presence of $PhNO_2$ or other liquids which are not miscible with H_2O , to introduce at least 3 atoms of Cl into the mol. The products yield marine-blue dyeings which are fast to H_2O . S chlorides as well as Cl may be used for the chlorination, which may be effected at $135-40^\circ$.

Dyes. BADISCHE ANILIN & SODA FABRIK. Brit. 261,888, Oct. 9, 1925. Bz-1-Chlorobenzanthrone or other Bz 1-halogenbenzanthrone having free 2-positions are

treated with mixts. of caustic alkalies and alkali alcoholates, *e. g.*, KOH and PrOH, in the presence of C_6H_6 or other inert diluents.

Azo dyes. BRITISH DYESTUFFS CORPORATION, LTD., M. MENDOZA and K. H. SAUNDERS. Brit. 262,243, Nov. 13, 1925. The *m*-diamines obtained by reducing the dinitrosulfones resulting from the condensation of the sulfonic acids derived from *o*-oxyarylcarboxylic acids with aromatic dinitro compds., contg. a labile halogen atom, as described in Brit. pat. 245,865 (*C. A.* 21, 504) are used as end components in the manuf. of azo dyes. Several examples are given of dyes which dye wool from an acid bath orange and brown shades becoming fast to milling when after-chromed.

Chromium compounds of azo dyes. I. G. FARBENINDUSTRIE AKT.-GES. Brit. 262,418, Dec. 1, 1925. The dyes are heated with salts of trivalent Cr, with or without pressure, in the presence of dissolved salts of metals which are not known to form metal compds. with the dyes other than salts of sulfonic or carboxylic groups present in the dye. The dye from diazotized 4-nitro-2-aminophenol-6-sulfonic acid and β -naphthol may be heated in an autoclave with a soln. of Cr formate and NaCl to obtain a product which dyes wool fast black.

Chromiable brown disazo dye. W. NEELMEIER, T. NOCKEN and W. REBNER. U. S. 1,643,222, Sept. 20. By coupling 3-diazo-5-sulfo-2-hydroxybenzoic acid with 1-naphthylamine-6-sulfonic acid, rediazotizing the monoazo dye formed and coupling with salicylic acid, there is obtained a dye which when printed on cotton with Cr compds. yields fast brown shades.

Treating effluents from dye works. P. MAHLER. Brit. 262,382, Dec. 3, 1925. Effluent solns. are decolorized with activated C and the latter is revived for reuse. A pptg. agent such as milk of lime and alum or Fe or Cr salts may be used to assist the decolorization and settling of the C. The C is added at or immediately after the formation of the flocculent ppt. The C may be revived by a chlorate or HCl and may be lixiviated to recover the dye.

Benzanthrone derivatives. I. G. FARBENINDUSTRIE AKT.-GES. Brit. 261,757, Nov. 17, 1925. Halogen substitution products of benzanthranyl-mercaptans, -sulfides and -disulfides or their derivs. are condensed with a phenol, a mercaptan, or an alc. Condensation products thus formed yield vat dyes when treated with alk. condensing agents. Dibromobenzanthranyl sulfide (made by melting dibromobenzanthrone with Na disulfide) is condensed with PhOH in the presence of K_2CO_3 and the product subjected to EtOH potash fusion to produce a dye giving bluish violet shades on cotton from the vat. By using β -naphthol instead of phenol a dinaphthoxybenzanthranyl sulfide is obtained which on alkali fusion yields dinaphthoxyisodibenzanthrone which also dyes cotton blue-violet. Dibromobenzanthranyl sulfide and *p*-cresol form a condensation product which when fused with EtOH potash yields a dye dyeing cotton reddish blue. Cf. *C. A.* 21, 2907.

Colored coating compositions containing nitrocellulose. BRITISH DYESTUFFS CORPORATION, LTD., H. JACKSON and D. CARTER. Brit. 262,601, Dec. 18, 1925. Uni- or multi-colored effects are produced on materials by bringing them into contact with solns. of celluloid or other nitrocellulose compn. contg. pigments or other colors and floating on H_2O .

Dyeing. I. G. FARBENINDUSTRIE AKT.-GES. Brit. 262,476, Dec. 7, 1925. Fibrous material is treated with a free amine such as aniline, H_2O and a solubilizing agent such as the Na salt of diisopropyl-naphthalenesulfonic acid or *N*-dibutylanilinesulfonic acid and then oxidized. The process is applicable to various dyeing and printing processes.

Dyeing and printing textile materials. AKT.-GES. FÜR ANILIN-FABRIKATION. Brit. 262,537, Sept. 17, 1925. The material is impregnated with an azo coupling component and a nitrite and treated in a sep. bath with an acid in the presence of a diazotizable amine. The process is applicable to cotton, cellulose acetate and similar materials. Several examples and modifications are described.

Dyeing furs, skins, hairs and feathers. O. KALTWASSER and H. KIRCHHOFF. U. S. 1,643,246, Sept. 20. Material to be dyed, in the presence of an oxidizing agent such as H_2O_2 and NH_3 , is treated with a soln. of diamino-2-hydroxynaphthalene obtained by dinitrating naphthalene 1,2-diazoxide, carefully treating the product with Na sulfide, and then reducing the NO_2 groups. Brownish dyeings are obtained.

Treating cloth with dyeing, bleaching or other liquids. C. H. CROWELL. U. S. 1,643,360, Sept. 13. A web of fabric such as sheeting is stretched and passed over a carrier roll and treated with material such as an aq. dyeing, bleaching or coating soln. which is forced into the material while on the carrier roll; the damp-treated fabric is rolled into a bundle roll while in peripheral contact with the carrier roll to prevent lateral

shrinkage of the fabric. U. S. 1,642,361 relates to an app. for drying, of the steam drum type.

Dyeing artificial silk and other materials. HEBERLEIN & Co., AKT.-GES. Brit. 261,792, Nov. 21, 1925. The process for varying the dyeing properties of vegetable fibers, described in Brit. pat. 255,453 (C. A. 21, 2805), is applied to various kinds of artificial silk which after this treatment loses its affinity for substantive dyes and acquires affinity for basic dyes. "Acetate silk" is particularly susceptible to the treatment. Brit. 261,793 specifies treatment of vegetable fibers or artificial silk with a halogen compd. of P in connection with either a preceding or a following treatment with alkali and with an intervening washing (and in some cases drying). Brit. 261,794 specifies a treatment of either vegetable fibers or artificial silk by a similar process in which treatment with a halogen compd. of P is effected in the absence of an alkali but in some cases in the presence of CaCO_3 or other salt or compd. which neutralizes liberated acid. "Acetate silk" thus treated acquires an affinity for basic dyes, while viscose is made insensitive to substantive dyes.

Apparatus for treating artificial-silk yarns with liquors for washing, bleaching, dyeing, etc. J. BRANDWOOD. Brit. 261,778, Nov. 20, 1925. For treatment with liquors under pressure or vacuum, the yarn may be wound on a bobbin formed of rods and end flanges of material resistant to corrosion such as Monel metal, ebonite or bakelite or varnished material. Brit. 261,779 also relates to app. in which similar bobbins may be used with circulating liquor.

Dyeing with aniline black. G. ARIS. U. S. 1,643,233, Sept. 20. Textile material to be dyed is treated with a bath contg. both aniline and an azo aromatic compd. such as an azo deriv. of aniline, toluidine or xylidine which is used in about 2% or less the quantity of the aniline and serves to increase the affinity of the color for the fiber dyed.

Dyeing cellulose acetate. G. H. ELLIS. U. S. 1,641,965, Sept. 13. A vat dye of the anthraquinone series is applied to the material in the unreduced state and is solubilized by a pretreatment, e. g., with Na sulfocinnolate. Cf. C. A. 21, 1361.

Dyeing cellulose acetate, etc. BRITISH CELANESE, LTD., AND G. H. ELLIS. Brit. 262,506, Sept. 7, 1925. In dyeing or printing with vat dyes fabrics contg. cellulose acetate with or without other materials such as cotton, the strong alkalies such as usually employed are replaced wholly or in part by salts of aromatic hydroxy derivs. such as Na or K phenates, cresolates, xylanolates, catecholates, resorcinates, guaiacولات, quinolates, α - and β -naphtholates, Na *p*-chlorophenate and di-Na leucoanthraquinonate. Numerous details are given.

Dyeing cellulose acetate. J. W. LEITCH & Co., LTD. AND A. E. EVEREST. Brit. 261,822, Aug. 11, 1925. Dyeing is effected by treatment with a soln. or suspension of a dinitroamino compd. in which the NO_2 groups are disposed adjacent to and at each side of the NH_2 group, e. g., 4-amino-3, 5-dinitro-1-methylbenzene, 4-amino-3, 5-dinitro-1-chlorobenzene or 1-methyl-3,5-dinitrodiaminobenzene. The dyeing is selective, cotton or "viscose silk" remaining undyed, and dyeing may be effected with or without heating. Production of yellow, orange and red shades is described and details are given.

Patterned effects on fabrics. HEBERLEIN & Co. AKT.-GES. Brit. 262,477, Dec. 5, 1925. Nitrated vegetable fibers are used in weaving fabrics and the fabric is then locally treated with an alkali so that the nitrated threads can be subsequently removed by heating and steaming.

Printing fabrics containing acetylcellulose. BRITISH DYESTUFFS CORPORATION, LTD., AND L. SMITH. Brit. 262,254, Nov. 25, 1925. White or colored discharge effects are produced on materials formed in whole or in part of acetylcellulose by adding thiocyanates to the usual Na formaldehyde sulfoxylate discharge printing pastes. Several examples are given.

Waterproofing textile materials and paper. C. J. MORETON AND WATERPROOFERS (MORETON'S PROCESS), LTD. Brit. 262,605, Dec. 24, 1925. A H_2O -proofing compn. comprises a soap-like emulsion together with Karaya gum. Textile materials may be treated with this compn. and subsequently treated with a soln. of Ti sulfate, ZnSO_4 , or alum. Paper may be passed through the emulsion and then calendered or the emulsion may be added to the pulp from which the paper is manufactured. Cf. C. A. 21, 2070.

Bandages or other fabrics with non-fraying edges. W. SPONHOLZ. Brit. 262,034, May 11, 1926. Threads of artificial silk are woven into (or laid upon) a fabric at places where edges are to be formed by cutting and these threads are caused to adhere by treatment with a solvent such as acetone or EtOAc .

Mercerizing yarns and fabrics. E. GMINDER. Brit. 262,154, Nov. 30, 1925. In mercerizing or similar operations of swelling by acids or alkalies, the material is cooled

in the stretching zone by passing over well-cooled surfaces, to avoid the decomp. effect of the heat otherwise developed.

Apparatus for mercerizing fabrics. MASCHINENFABRIK BENNINGER AKT.-GES. Brit. 262,343, June 24, 1926.

Conditioning textile fibers by oil atomized with steam under pressure. R. B. SMITH. U. S. 1,642,092, Sept. 13.

26—PAINTS, VARNISHES AND RESINS

A. H. SABIN

Oxys. V. Oil films considered colloid-chemically. A. EIBNER AND H. MUNKERT. *Chem. Umschau Fette, Oele, Wachse u. Harze* **34**, 183-9, 206-11(1927); cf. C. A. **21**, 2071.—An examn. of various 6 months' old oil films and of their drying oils is discussed, with tables of analysis.

	Wood oil	Linseed oil	Boiled linseed oil	Wood oil film	Tokyoil oil film	Linseed film	Boiled linseed film	Boiled eleostearic acid film
I no.	151.1	173.5	63.7					
Acid no.	3.8	2.3						
Sapon no.	193.3	191.5						
Hexabromide no.		50.7						
% sol. in ether and alc.				60	86	36	64.5	76
% sol. in ether and alc.				40	14	64	35.5	24
% sol. in hot H ₂ O				2.5	2.0	4	3.5	(acetone)
% sol. in ether				10.5	8.0	10	8.0	
% sol. in alc.				27	4.0	50	24.0	

The ether-sol. portion of the films consisted largely of satd. fatty acids, while the alc.-sol. portion contd. mostly hydroxy-glycerides. Kept in a closed bottle a linseed-oil film became a brown sirup in 2 yrs.; boiled linseed oil films and boiled wood oil films remained essentially unchanged after 7 yrs. The % of sol. and insol. portions in young dry films is tabulated:

Film	Drying time	% sol.	% insol.	% insol after 6 months
Fresh wood oil	1½ days	85	15	60
Tokyoil	1-2 hrs.	83	17	86
Fresh linseed oil	7 days	72	28	36
Boiled linseed oil	12 days	50	50	64

These films are solid solns., formed by a flocculation reaction; the amt. and nature of the gels vary with the oil and the sols are glycerides of β -eleostearic acid (in wood oil) and α - and β -linolic acid (in linseed oil). Wood oil dries more rapidly at low O₂ absorption because it gelatinizes more readily than linseed oil and keeps absorbing O₂ through its surface up to a 14% increase in wt., followed by no essential decrease. Linseed oil gelatinizes less readily and dries therefore at max. oil absorption (17.5%) and decrease in wt. follows. Analysis of the wood oil film exts.: (1) H₂O ext. acid no. 82.2, I no. 3.68. (2) Alc. ext. acid no. 123.74, sapon no. 205.9, ester no. 82.2, I no. 3.68. (3) H₂O ext. acid no. 90.13, sapon no. 203.37, ester no. 113.3, I no. 2.00. A wood oil film 6 months' old, was placed in a closed jar where it developed a sharp acid odor after 2 weeks and became sticky. Microscopic, ultra-microscopic and Röntgen ray examn. could be practiced more extensively in connection with paint films. P. ESCHER.

Automobile finishing. H. C. MOUGEY. *Ind. Eng. Chem.* **19**, 1102-3(1927).—The relation of the chemist to the paint and varnish industry is reviewed. Black baking enamels and lacquers for automobiles are discussed, advantages of lacquer over varnish both, and further work for the chemist is pointed out. R. J. MOORE.

Cellulose varnishes and paints for automobiles. MAURICE DESCHIENS. *Rev. gen. mat. plastiques* **3**, 233-6, 297-300, 437-9, 498-501(1927).—A discussion of their raw materials, properties, compn., prepn., applications and mode of applying.

The application of water japan. W. J. MISKELLA. *Fuels and Furnaces* **5**, 1203-6, 1927).

A primer on lacquer spraying. W. D. MILNE. *Quarterly Nat. Fire Protection*

Assoc. 21, 55-72(1927).—A summary of hazards in spraying pyroxylin lacquers, regulations, fire record classified as to causes, and a discussion of the effectiveness of sprinkler operation in connection with lacquer and varnish spraying fires. It is accompanied by a record of 19 such fires leading up to the \$2,000,000 Briggs body plant pyroxylin lacquer fire. C. L. JONES

Synthetic resins. A. V. H. MORY. *Ind. Eng. Chem.* 19, 1106-9(1927).—An address covering the use of phenol condensation products in the automotive industry. General properties and applications of the resins are reviewed, together with the forms in which a large class of resin materials is offered to the fabricator of finished parts. Future possibilities are discussed. R. J. MOORE

Proper fusing of enamel vital. F. W. MANKER. *Iron Age* 120, 531-4(1927).—A brief illus. description of enameling and japanning operations at the plant of the Detroit-Michigan Stove Co., Detroit, Mich. Three coats of enamel are usually burned on at temps. varying from 760° to 870° in 3-5 min., by gas with the air supply regulated by venturi-meter proportioners. Temps are regulated by automatic pyrometer controls. Japanning is conducted at about 232° for approx. 50 min. W. H. BOYNTON

The oleo-resinous secretory system of the maritime pine. H. DEVAUX AND A. BARGUES. *Bull. inst. pin.* No. 37, 131-5(1927); *P. I. A. Abstracts* 1, 1(1927).—The location and movement of resinous secretions were studied by staining secretions taken from a year-old twig with suitable stains. The oleo-resinous secretion is not entirely localized in the cells that border the secretory canals, but is a property of all the living cells of the stem except those that produce tannin. The living parenchyma of the medullary and cortico-bast regions communicates with the secretory canals by means of the medullary rays, which, with their elongated cells and delicate walls, are so constituted as to allow the passage of the oleo-resin to the canals. The secretion is acid only in the canals, and is neutral in all the other living portions. The change does not actually occur until the resin reaches the canal, although a premature change sometimes occurs in the cells immediately bordering the canals. The finding of neutral substances in the cells bears out the work of Dupont (*C. A.* 19, 648), who suggested the presence of a neutral (probably aldehydic) parent substance, or "mother of resin," in the tree. A. PAPINEAU-COUTURE

The process of flow of turpentine (oleo-resin) from some species of the conifer family. A. E. ARBUZOV. *Bull. inst. pin.* No. 37, 137-9(1927); *P. I. A. Abstracts* 1, 1-2(1927).—A method of collecting oleo-resins without loss of volatile constituents was devised, consisting essentially in removing the dead bark, boring a hole 4 cm. in diam. and 1.5 cm. deep through the cambian layer, and immediately inserting an Fe pipe with side tube leading to a graduated tube. Working on *Pinus sylvestris*, in the state of Kasan (Russia), A. found that the period of flow is represented by a parabolic curve, and practically ceases after 11 hrs. He does not consider the oleo-resin has any cicatrizing action on wounds in trees. Measurement of the pressure in the resin canals by means of a Hg manometer gave values of up to 3.5 atm. (and the true values are probably even higher than indicated), max. pressure being usually obtained after 3-4 hrs. Measurements at different heights showed a decrease in pressure from base to top, which was attributed mainly to a general lack of oleo-resins in the resin canals. Measurements on a recently felled tree showed only a weak pressure, which rapidly fell to zero. With firs the rate of flow was found to be much slower (5-6 days required to reach a max.), and the max. pressure observed was 2 atm. A. considers that the pressure developed in the resin canals is due to the tension of the turgescient tissues which surround the canals, and that the greater yields obtained during periods of low barometric pressure are really due to the increased humidity that usually accompanies such a condition. This, together with a longer growing season, probably accounts for the better yields obtained from *P. maritimus* of France than from *P. sylvestris* of Russia. The oleo-resin obtained crystd. quickly, despite efforts to prevent it, but no other apparent changes occurred. Crystn. occurred more quickly in moist than in dry weather, presumably owing to lower temp. The oleo-resin as it exists in the resin canals is thought to be a supersatd. soln. of solid resin acids in terpenes. A. P. C.

Composition of the turpentine (oleo-resin) of *Pinus sylvestris*. B. A. ARBUZOV. *Bull. inst. pin.* No. 37, 140-2(1927); *P. I. A. Abstracts* 1, 2-3(1927); cf. preceding abstract. —A study of the oleo-resin collected as described above. The colorless viscous filtrate sepd. from the cryst. portion of the resin had n_D^{20} (100-mm. tube) —12.44° to —18.62°, coeff. of rotatory dispersion (α_1/α_0) 2.16-2.61 and contained 50% turpentine. After carefully warming at 140-50° to redissolve all the cryst. ppt. the whole resin had n_D^{20} —33.89° to —60.97° and contained up to 37% turpentine (steam and vacuum distn. gave identical results). The turpentine contained 87% α -pinene and no β -pinene. The

rotatory dispersion of the 1st fractions (80–90%) was const. at 1.97, and is suggested as a test for the quality of Russian turpentine, but would probably not be suitable for turpentine contg. much β -pinene. α -Pinene obtained by repeated fractionation b_{767} 155.7° and had d_{20}^{20} 0.8580, $[\alpha]_D + 40.79^\circ$, α_1/α_0 1.969. α of the rosin varied with temp. of distn., quality of the oleo-resin and nature of solvent used: $[\alpha]_D$ and α_1/α_0 of the pure rosin (no solvent) were -10.44° , 2.68; in EtOH soln. -4.96° to -74.70° , 2.37–2.52; in C_6H_6 -3.73° , 2.52, resp. The white, cryst., powdery mass sepd. from the oleo-resin as collected had $[\alpha]_D$ (in alc.) -60° to -94.5° , m.p. 118–30°, α_1/α_0 2.37, α_2/α_1 1.168. On keeping in a glass-stoppered bottle the cryst. portion turned yellow and acquired a sour odor. $[\alpha]_D$ (in C_6H_6) immediately after filtration and at the end of 11.5 months changed from -41.69° to $+12.86^\circ$. The solid portion of a sample of oleo-resin that had been kept in a cork-stoppered bottle for 41 yrs. had $[\alpha]_D$ (in C_6H_6) -45.89° , α_1/α_0 2.37.

A. PAPINEAU-COUTURE

Contribution to the study of abietic acid. Influence of water and of solvents on the rotatory power of abietic acid: a physico-chemical study of the question. G. DUPONT, G. ROUTIN and J. DUBOURG. *Bull. inst. pin* No. 38, 157–62 (1927); *P. I. A. Abstracts* 1, 15–7 (1927).—Previous work by D., R. and D. has shown that ordinary abietic acid exists, not as the anhyd. $C_{20}H_{30}O_2$, but probably as the more complex hydrated form $4C_{10}H_{16}O_2 \cdot H_2O$. Cryoscopic measurements have shown that it exists as a double mol. in C_6H_6 soln. Results of vapor-pressure measurements on solns. of fused abietic acid in various solvents are given, and the effects of diln. in various solvents on the α of abietic acid are shown graphically. In each case the cryst. acid has greater l -rotatory powers, which might be due to the formation of a slight amt. of d -pyro-abietic acid during fusion or to absence of H_2O which seems to increase the l -rotation. The α was found to be practically unaffected by a variation in concn. in the case of solns. in C_6H_{12} , petroleum ether and CCl_4 . The variation in values obtained with the other solvents is attributed to mol. association in the solvent and subsequent disson. of the complex mol. on diln.

A. PAPINEAU-COUTURE

Linoxyn and linoleum. A. D. LUTTRINGER. *Caoutchouc & gutta-percha* 24, 13,636–9, 13,668–72 (1927); cf. *C. A.* 21, 2808.—Large-scale app. and equipment are described.

C. C. DAVIS

Electrolytic white lead (ANON.) 4. A new cellulose ester [for the manufacture of varnishes] (ANIEF) 23. Enamelled leather (Brit. pat. 262,780) 29. Artificial masses, lacquer, etc. (Can. pat. 272,494) 18.

SABIN, ALVA HORTON: **The Industrial and Artistic Technology of Paint and Varnish.** 3rd ed., revised and enlarged. New York: John Wiley & Sons, Inc. 459 pp. \$5.00; 25s.

SABIN, ALVA HORTON: **Red Lead.** How to Use It in Paint. 3rd ed., revised and enlarged. New York: John Wiley & Sons, Inc. \$2.00; 10s.

SABIN, ALVA HORTON: **White Lead.** Its Use in Paint. 1st ed. New York: John Wiley & Sons, Inc. \$1.25; 5s. 3d.

Paint. J. BLUMENFELD. Can. 272,238, July 12, 1927. A liquid coating material is prepd. by adding to Ti_2O_3 and linseed oil a metallic O_2 compd. which is capable of reacting with acids to liberate H_2O_2 .

Submarine paint for ships, etc. E. GIOVAGNOLI. Brit. 262,486, Dec. 7, 1925. Boiled oil and oil varnish are used with turpentine, beeswax, zinc white, resin, natural cement, "liquid para" and As_2O_3 .

Lithopone. W. C. HOOGY. Can. 271,610, June 14, 1927; Brit. 263,119, Dec. 15, 1925. In the manuf. of lithopone, the end point of the reaction between the $ZnSO_4$ soln. and the BaS soln. in the pptg. step is detd. by testing the filtrate of a sample of the crude pulp for OH and SH radicals.

Lithopone. W. C. HOOGY. Can. 271,611, June 14, 1927; Brit. 263,120, Dec. 15, 1925. In the manuf. of lithopone, the alky. of the finished lithopone is controlled to a desired extent by establishing in the crude pulp at the end point of the pptg. step such a predetd. excess of and ratio between the OH and SH radicals as will give the desired alky. to the finished lithopone after calcination.

Coating with nitrocellulose lacquers. WOLFF & CO. AND H. SCHULZ. Brit. 262,440, Dec. 4, 1925. A preliminary binding layer which adheres firmly to wood, metal or other surface, and which contains nitrocellulose having a N content above 12.6%

and incomplete ether-alc. soly. is first applied, and overlying coatings of different character may then be applied.

Forming inlaid linoleum. C. F. HUMPHREYS and J. C. MCCARTHY. Brit. 261,950, Feb. 2, 1926. Mech. features.

Filler for wood and metal. A. HINZE. Can. 272,153, July 5, 1927. A filler compn. for wood and metal is composed of 45-65 parts of a filler base, 8-15 parts of a soft resin, and a volatile solvent of the resin. Cf. C. A. 20, 3242.

Coating composition. J. M. KESSLER. U. S. 1,642,155, Sept. 13. A coating compn. suitable for use on metal or other surfaces comprises a fused fossil resin such as kauri, congo, or copal 100 together with solvents and a softener comprising China wood oil and linseed oil, 20-25 parts.

Synthetic resin. J. MCINTOSH and E. Y. WALFORD. U. S. 1,642,078, Sept. 13. An initial condensation product is formed from glycerol and PhOH or other suitable phenolic compd. and the initial condensation product is subjected to further condensation in the presence of a hardening agent such as $(CH_2)_6N_4$ to obtain a solid infusible product. U. S. 1,642,079 (J. MCINTOSH) specifies the production of a dense infusible product insol. in alc., acetone, C_6H_6 and other ordinary org. solvents.

Purified rosin. W. B. LOGAN. U. S. 1,643,276, Sept. 20. In order to render wood rosin more suitable for use as a substitute for gum rosin in sizes, etc., it is heated to about 150-160° until the "nigre" is rendered sol. in solvents for rosin.

Purifying liquid rosin. L. H. BJÖRKGREN, G. U. SELANDER and J. H. MELLQUIST. Can. 272,392, July 19, 1927. Liquid rosin is dissolved in benzine and HCl is introduced, and the soln. is exposed to the action of fuller's earth. The ppt. is removed and the benzine driven off.

27—FATS, FATTY OILS, WAXES AND SOAPS

E. SCHERUBEL

What is a refined oil? HERMAN ASPGREN. *Oil and Fat Ind.* 4, 298-303 (1927).—This is a discussion of the impurities and specifications of the N. Y. Produce Exchange, the New Orleans Cotton Exchange and Interstate Cottonseed Crushers Assoc. From the manufacturers' point of view the expression "refined oil" is a broad definition and means quite different qualities from those it represented 20 or 40 yrs. ago. E. S.

Contribution to the chemical study of (oil-bearing) Malvaceae. J. PIERAERTS. *Mat. grasses* 18, 7611-4, 7640-3, 7667-9 (1926); 19, 7724-8, 7752-4, 7778-80, 7808-13, 7834-6, 7882-5, 7890-3 (1927).—The investigation was concerned primarily with the specificity of the Halphen test. Analyses of a large number of different kinds of seed oils (obtained by hot, and by cold extn. with anhyd. Et_2O) were made. Conclusions. (1) Halphen's reagent is characteristic of Malvaceae, rather than merely of Malvaceae; (2) contrary to Ubbelohde, Malvaceae do not all give a positive Halphen test; (3) no Tiliaceae give the test, but all Bombaceae give it very strongly; (4) some members of the genus *Hibiscus* give positive and others negative tests, and similarly with the genus *Sida*; (5) the negative results given by Samarkand cottonseed oil must be due to the age of the seed examd.; (6) all Sterculiaceae (except those belonging to *Theobroma* and *Cola* genera) give very intense Halphen tests; (7) nearly all the Bombaceae and Sterculiaceae oils are non-drying. Analyses are given of various parts of the plant *Heritiera littoralis*, Ait.

A. PAPINEAU-COUTURE
Solvent extraction of the soy bean. A. K. SCHWARTZ. *Oil and Fat Ind.* 4, 284-8 (1927).—The process described was developed in Germany and has been in operation for 10 years. It is based on the principle of continuous operation and counter-current flow and is divided into 3 semi-independent units: extn. proper, solvent recovery from extd. meal, and oil recovery or distn. unit. The extractor is a large bucket elevator, the buckets having false bottoms and filled from a hopper above the extractor, while at the highest point of their flight. They descend on the right side, being simultaneously treated with oil solvent effluent obtained from the left side of the extractor. In the ascending side the material is treated in counter-current with fresh solvent. The bucket ascending past the solvent zone goes through a draining period and upon again reaching its highest point is dumped in a hopper below, from which it is delivered to the drying app. The whole is enclosed in an iron casing. The drying app. consists of a series of specially designed, jacketed tubes, within which the meal is heated and steamed. After traveling the full length the meal is delivered through a lock as finished meal. Evaporators, fractionating columns, heat exchangers, H_2O separator, surface

condensers and an oil scrubbing tower for solvent recovery from vented air constitute the recovery unit. A mixt. of benzene and alc. is used. The alc. enables the recovery of vegetable phosphatides. A table of 6 months operation is given representing 8000 tons. Extd. meal analyzes 8.60 to 15.53% H_2O , 0.40 to 0.90% fat, 47.20 to 48.45% protein, 3.53 to 5.0% fiber and 5.10 to 5.4% ash. No solvent is left in the meal and it is used for human consumption and commands a premium over pressed soy meals. E. S.

Experiments on sunflower seed oil. H. F. FRENCH AND H. O. HUMPHREY. Missouri Univ. Eng. Expt. Sta., *Bull.* 25, 27 pp. (1926).—A study was made to det. the industrial uses of sunflower seed oil. KOH proved the best bleaching agent followed by a method using fuller's earth and activated C. The oil has a disagreeable odor when heated and smokes at a low temp. Steam distn. did not improve the taste, nor make it suitable for salad oil. Partial hydrogenation of the purified and steam-distilled oil gave a product which was satisfactory as a frying oil. It was not satisfactory as a drying oil. It dried slower than linseed oil and is not suitable for paints. J. J. SKINNER

Tea-seed oil and its uses as an adulterant of olive oil. H. A. CAULKIN. *Pharm. J.* 118, 769-70; 794; *Chemist & Druggist* 107, 39-40 (1927).—J. COFMAN-NICORESTI. *Pharm. J.* 119, 58 (1927).—The phys. and chem. const. of 4 samples of tea-seed oil (1), pressed or extd. from seeds, are recorded. However, neither these const. nor the proposed color tests for A (cf. C. A. 14, 2099; 16, 1019) permit detection of the adulteration of olive oil with A. C.-N. points out that olive oil is now low in price compared with A, which precludes its present use as an adulterant. He upholds the usefulness of his color test. S. WALDBOTT

"Aouara." ANON. *Bull. agence gén. colonies* 19, 1180 (1926); 20, 73 (1927); *Bull. Imp. Ind.* 25, 157 (1927).—"Aouara" is the name applied by the natives of French Guiana to the palm, *Astrocaryum aculeatum*, Mey., which is the "Tucum" of Brazil or "Tucumua" of British Guiana. The fruit contains 23.3% pericarp, 52.5% shell and 24.2% kernel. The pericarp contains 9.3% H_2O and 34.38% of brown semi-solid oil (by extn.) m. 22-3°, d_{20}^4 0.887, sapon. no. 184. The oil-free pericarp contained 9.75% protein on the dry basis. The kernel (3.8% H_2O) contained 24.5% of white to creamy-white solid fat m. 32°, acid no. 1.18, sapon. no. 211-4, I no. 9.56-10.0, unsapon. matter 0.6%, Reichert-Messl no. 0.6, d_{17}^4 0.915. The meal from the extn. of fat from the kernels contained 6.65% of proteins on the dry basis. A. PAPINEAU-COUTURE

Dry rendering of animal products. R. P. BENNETT. *Oil and Fat Ind.* 4, 275-83 (1927). The dry-rendering process has the following advantages over the wet-rendering system and has therefore become popular in a short time: (1) the dry system is far more rapid, its products are more valuable; its products are of higher grade; it requires less labor, it requires less machinery, power, and steam; it requires less floor space; it requires less investment; it is simpler and it is odorless and clean. E. SCHERUBEL

Advantages of purely absorptive carbon in decolorizing. J. P. HARRIS. *Oil and Fat Ind.* 4, 273-4 (1927).—While there is no complete bleaching agent for cottonseed oil without a catalytic action tending to oxidation, there is a non-acid, vegetable activated decolorizing C, which produces decolorizing by pure absorption. It possesses a strong affinity for resins, albuminoids, phosphatides, mucilaginous matter, and natural pigmentation. Temp. has little effect upon it and it can be used below 180° F. No flavor is imparted to the oil. E. SCHERUBEL

The bleaching action of bleaching earths (clays) upon oils. GUSTAV KEPPELER. *Angew. Chem.* 40, 409 (1927).—Supplementing Neumann and Kober's article on the same subject (C. A. 21, 2811), it is shown that clays contain certain colloidal humus substances, that these are concerned in the bleaching action, and that they are altered or destroyed when exposed to high temps. The change in the bleaching power of a clay at high temp. is therefore to be considered as due to the above action rather than to a change in the adsorptive qualities of the clay. W. C. EBAUGH

Determination of some physical constants of oils from marine animals. HENRI MCKELET. *Compt. rend.* 185, 455-7 (1927).—Heats of combustion, flash points, fire points, sp. grs., fluidities and viscosities are tabulated for 29 marine oils. E. R. S.

Reply to J. Davidsolhn's remark on "Detection of fish oils." MITSUMARU TSUJIMOTO. *Chem. Umschau Fette, Oele, Wachse u. Harze* 34, 217 (1927).—The cause of D.'s failure to detect fish oils by T.'s method lies probably in the use of a faulty reagent, D. used I in ICl; the reagent should not contain an excess of I but rather an excess of Cl. Additional tests confirmed the conclusions in T.'s former publication (C. A. 21, 661). P. ESCHER

Deodorizing menhaden fish oil. E. E. RANDOLPH. *J. Elisha Mitchell Sci. Soc.* 42, 1 (1926).—A successful method for deodorizing menhaden oil consists of gently heating it with CH_2O and a small proportion of HCl and then blowing superheated

steam through it. An acid with the formula $C_{17}H_{33}O_2$ was sepd. from this oil and is thought to be the chief cause of the fishy odor. A. L. MEHRING

The quality of the fish oils from the standpoint of the hardened oil industry of Japan. II. The sardine oil. SEI-ICHI UENO AND KIYOJI YASUHARA. *J. Soc. Chem. Ind. (Japan)* 30, 348-50(1927).—The characteristics of 75 samples of the commercial sardine oils of Japan are given in a table. The oils had d. 0.927-0.933, n_D^{20} 1.479-1.481, sapon. values 187-197, I values 160-190, acetyl values 18-30, and Hehner values 95-96. The Reichert-Meissl value was always under 1.0. The acid value was irregular, but generally lower than that of the herring oil. From the values obtained, the commercial sardine oils often contain some herring oils. Y. NAGAI

The hardened fats. A. BOURGOM. *Bull. fed. ind. chim. Belg.* 6, 305-10(1927).—A survey. A. L. HIENNE

Notes on titer test of fatty acids. L. A. SPIELMAN. *Chemist-Analyst* No. 47, 7; *Chem. Zentr.* 1926, II, 1705.—The method is that of the Am. Assoc. Agr. Chemists. Heat the glycerol-KOH mixt. to 150° in a 1. Erlenmeyer flask, instead of a dish or beaker, add the melted fat and saponify completely. Dissolve the resulting soap by adding hot water and siphon off the aq. soln. upon which the fatty acids floats. Wash the acids and titrate in the usual manner. W. T. H.

Sulfonated oils and the technical preparations made from them. H. POMERANZ. *Seifensieder-Zig.* 54, 272-3, 289-90(1927).—By a modified Grün method of sulfonating oil with $ClSO_3H$ P. converted castor oil into a product completely sol. in H_2O , highly resistant toward acids Ca, Mg and electrolytes but unsuited for Turkey red oil on account of its yellow tint. A pure sulfonic acid product from pure ricinic acid and $ClSO_3H$ formed in H_2O a glassy transparent solid gel. P. suggests that 2 mols. of $ClSO_3H$ split off HCl, the SO_3 adds to the double bond and the product is hydrolyzed to an acid contg. the group $-(HO)CHCH(SO_3H)-$. This assumption harmonizes better with the facts than the older theories. P. ESCHER

Fat splitting by means of naphthasulfonic acids. G. S. PETROV, S. I. DIMAKOV AND F. T. TAKSA. *Seifensieder-Zig.* 54, 163-6, 182-4, 204-5, 221-2, 241-2, 261-2, 284-5(1927).—Naphthasulfonic acids are formed during the refining of petroleum distillates with concd. or fuming H_2SO_4 , when dehydration, sulfurizing, sulfonation and polymerization occur. Treatment of the sludge with more H_2SO_4 seps. the oily constituents, which are washed with dil. alc. or acetone, and from the latter soln. the sulfonic acids are extd. Technical sulfonic acids are viscous and transparent, sol. in alc., ether, C_6H_6 and H_2O , producing a lather on shaking. When heated, they dissolve 80-90% mineral oil and then form permanent emulsions. Naphthasulfonic acids from solar oil have the formula $C_{20}H_{33}SO_4$ and are satd. monosulfonic acids, used as a Twitchell reagent for splitting fats. *Effect of varying quantities of "contact" reagent in splitting coconut oil.*—The highest yield of free fatty acids (91.2%) is obtained with 2% reagent and 0.45% H_2SO_4 at the end of 10 hrs. with a H_2O : oil ratio of 0.4 to 1.6; increase of reagent to 10% does not increase the yield of free acids but slows down the reaction at times. Sweet H_2O settles well up to 0.9% reagent, then forms emulsions from 1 to 5%, and seps. again from 5 to 10%. *Effect of varying the amt. of H_2SO_4 .*—The highest yield was obtained with 0.50% H_2SO_4 , with a H_2O : oil ratio of 1.05 to 1.15; greater amts. of H_2SO_4 do not go parallel to the yield. Factory yields for tallow, palm oil, bone grease and coconut oil are tabulated; they range under varying conditions from 83.4 to 94.5%. Addition of sulfates of Ba, Na, or Ca retard the reaction in sunflower oil at below 100°. The presence of metallic Pb, Zn, Fe or Al retards the reaction at 85° with sunflower oil, and part of the metal is found in the ash of the fatty acids. *Temperature.*—There occurs little splitting at 60° but it increases to 85% yield at 90°. A comparative test of mechanical stirring against direct steam stirring showed slightly in favor of steam. The use of Ba, Al or Ca naphthasulfonates diminished the yield, especially during the 2nd period. A portion of the fatty acids was mixed with neutral fat, some H_2SO_4 added and the operation continued; the newly split acids gave a measure of the splitting power, and the results showed that the greater part of the sulfonic acids had migrated into the fatty acids and caused splitting. In using "Contact" reagent without any H_2SO_4 the following results were obtained: 1%, 2% and 3% reagent yielded 39.3, 40.18 and 90.06% fatty acids with sunflower oil, while 2 and 3% yielded 77.48 and 92.61%, resp., with tallow. *After-darkening of the fatty acids.*—Up to 91% yield the "Contact" reagent does not darken the fatty acids any more than the autoclave method with Zn and ZnO ; the dark color is considerably bleached by washing with 15-20% H_2O contg. 0.05-0.10% Na_2CO_3 . The dark color increases with increasing H_2SO_4 , and still more with increasing sulfonic acid content in the fatty acids, probably by re-forming H_2SO_4 . Fe salts greatly darken the color. The key for light color

of the product lies in the use of a pure reagent and of well purified oil. By adding some color-absorbing agent to the "Contact" reagent, acids of the same color are obtained as by sapon. though not equal to the color of the original oil. Comparing "Contact" reagent from various sources with "Idrapid" agent: "Idrapid" agent is not a 100% sulfonic acid and its H_2SO_4 content is higher than that of the "Contact" reagent from American and Russian oils, and without any extra H_2SO_4 it can split only oils that have been purified by H_2SO_4 , forming SO_2 esters and retaining some free H_2SO_4 . A tabulation of the N content of oils commonly split shows variation between 0.012 and 0.024% N. Sunflower and linseed oils were purified with varying strengths of H_2SO_4 and then split. The results show that the drying and semi-drying oils which have been purified by alkalis are unfit for "Contact" splitting and that the best results are obtained on oils purified by 20–50% (of the oil) of 1–5% H_2SO_4 or by HCl. Cleavage of coconut oil in the presence of 6–50% free glycerol showed after 4 hrs. only 78.48 to 57% yield as against 82.11% under normal conditions. Addition of equal parts of stearic or oleic acid to sunflower or linseed oil retards the reaction still more than glycerol. Cleavage by "Contact" reagent is due to hydrolysis speeded up by the 2 catalysts H_2SO_4 and sulfonic acid assisted by the emulsifying power of the latter. Salts which neutralize emulsification or acidity are detrimental. Stirring may be accomplished by direct steam or with a mechanical stirrer. Increase of H_2SO_4 does not increase the reaction in oils contg. satd. fatty acids but increases it in oils contg. unsatd. acids. Oils should be purified with dil. acids. The H_2O used for cleavage should be free from Ca, Mg and Fe. P. E.

Glycerol content and specific gravity of glycerol lyes. WILLY PRAGER. *Chem.-Ztg.* 51, 589–90(1927).—Stiepel's formula is discussed. The sp. gr. of glycerol lye depends on the glycerol content, the ash, and the org. residue, and in the formula the latter is disregarded. Results compared with actual detns. show that the formula is inaccurate.

E. SCHERUBEL

Complete saponification in the manufacture of soap base. C. STIEPEL. *Seifensieder-Ztg.* 54, 360(1927). HANS PIEPER. *Ibid* 375–6.—Comments on the work of Davidsohn (C. A. in print). Reply. J. DAVIDSOHN. *Ibid* 376, 414. P. ESCHER

The analysis of soap. L. V. DOUAU. *Rev. parfumerie* 7, 327–31(1927).—Brief outline of the usual methods of analysis.

A. PAPINEAU-COUTURE

Flake soap and washing compounds. J. H. FRYDLENDER. *Rev. prod. chim.* 30, 561–4, 601–7(1927).—Descriptive of mfg. methods, properties and methods of analysis.

A. PAPINEAU-COUTURE

The finishing of grained soaps by the tongue test. R. KRINGS. *Seifensieder-Ztg.* 54, 581–2(1927).—By means of the tongue test a practical soap boiler will pronounce 0.2 to 0.3% free NaOH in the kettle charge as being a mild excess; 0.3–0.6% as medium to strong; 0.6–0.8% as strong and 0.8–1.0% as a very strong excess of alkali.

P. ESCHER

Determination of potassium and sodium in pure shaving soaps. W. OTT. *Seifensieder-Ztg.* 54, 584–5(1927).—When a shaving soap contains no mineral filler, the % K_2O and % Na_2O can be detd. by the method of "indirect analysis" from the % fatty acids, their mean mol. wt., and the % ash ($K_2CO_3 + Na_2CO_3$).

P. ESCHER

Acetin and dichromate methods for glycerol analysis. O. SACHS and K. RIEMER. *Z. deut. Oel Fett. Ind.* 46, 739–40(1926).—Referring to Prager's article (C. A. 20, 3827) and R. cite examples from routine factory control in which parallel analyses by the acetin and dichromate methods of concd. glycerol from well-purified lyes furnished practically identical results, the acetin method receiving preference.

P. ESCHER

Utilization of marine animal and fish oils (as fuels) in motors (LUMET, MARCELET)
21. Jute seeds (SEN) 11D. Test for CS_2 (SACCARDI) 7.

THIRSAM, R.: *Fabrication des savons industriels. Emulsions pour l'ensimage et huiles solubles.* 3rd ed. Paris, 1927: Dunod. 308 pp. 60.20 francs (bound); 50.40 francs (paper). Reviewed in *Rev. prod. chim.* 30, 570(1927).

MARCELET, HENRI: *Les huiles d'animaux marins.* Paris: Ch. Béranger. 35 francs. Reviewed in *Ann. office nat. comb. liquides* 2, 210(1927).

Catalytic transformation of triglycerides. CHRISTIAN VAN LOON. Dutch 16,708, Aug. 15, 1927. Internal ester rearrangements in fats and oils are performed by the catalytic effects of (1/2 to 1%) metal salts (Cd, Sn, Zn, etc.), Na ethylate, sulfonic acids, etc., at temps. around 200° to 250° and reduced pressure if necessary.

Reaction products from cashew-nut shell oil. M. T. HARVEY. Brit. 262,184,

Nov. 28, 1925. Reaction products varying from jelly-like materials to hard rubber-like products are formed from the oil found in the shell surrounding the kernel of the cashew nut and glycerol. Reaction may be induced by heat or by the action of H_2SO_4 or other acids or by NH_3 . The reaction products, including vulcanized products, are sol. in solvents such as CS_2 , naphthol, $PhOH$ and C_6H_6 and form tough elastic films when a soln. is spread on a surface and dried at 100° . Cf. *C. A.* **21**, 3476.

Preserving vegetable oils. G. E. SCHARFF and NOBEL'S EXPLOSIVES CO., LTD. Brit. 261,863, Sept. 3, 1925. Vegetable oils used in coatings for fabrics, paper, etc., (and which may be assocd. with nitrocellulose, camphor, and pigments or fillers) are preserved by the addn. of about 2% of an aromatic non-hydroxy-nitro compd. such as dinitrotoluene, dinitrobenzene, nitronaphthalene or dinitrochlorobenzene.

Sulfo-aromatic fatty acids. G. PETROFF and P. SIESTAKOFF. U. S. 1,642,595, Sept. 13. In order to obtain products suitable for use in splitting fats, impure sulfo-aromatic fatty acids such as those from $C_{10}H_8$ are dissolved in a mixt. of benzene and C_6H_6 , the sulfo-aromatic fatty acids are extd. from the soln. by adding an aq. soln. of $EtOH$ or other alc. of low mol. wt., the mixt. is allowed to stand, the aq. layer of sulfo-aromatic fatty acids in soln. is sep'd. and the acids are recovered from the soln., e. g., by evapn.

Soap. A. WELTER. Can. 272,139, July 5, 1927. A durable air-resisting soap is produced by adding a fat solvent and pulverized calcined soda, whose content of H_2O does not exceed 30% of its wt., to highly split or distd. fatty acid, the quantity of soda being sufficient but not more than double the amt. required for sapon. These ingredients are intimately mixed until a perfectly uniform soapy mass results, to which grain soap or soap paste is added and the product milled. Cf. *C. A.* **21**, 2813.

Soap. H. H. VON KORNATZKI. Can. 271,920, June 28, 1927. Succinic soap is produced by adding to an ordinary fresh soap mixt. spirit, essential oil and an aq. soln. of succinic acid.

Soap tablets. C. DAVIS. Brit. 262,178, Sept. 2, 1925. A casing of starch and froth-producing material such as soap or cetylsulfonic acid or other froth-producing material contains a filling which may comprise glycerol, Na perborate and talc or other vegetable, animal or mineral emollients.

28- SUGAR, STARCH AND GUMS

F. W. ZERBAN

Future development of the sugar industry (Mauritius). H. A. TEMPANY, *et al.* *Rev. agr. Maurice* **4**, 100-21 (1927).—A report on measures to be taken, on the basis of exhaustive economic data for Mauritius and other countries producing cane sugar.

F. W. ZERBAN.

Manufacture of "extra fine" sugar. J. DE SPEVILLE, *et al.* *Rev. agr. Maurice* **4**, 121-31 (1927).—Calcs. are given in the form of tables, showing the cost of and profit to be derived from the manuf. of different grades of white sugar, and of raw sugar, taking into consideration only the operating costs, but not the cost of first installation.

F. W. ZERBAN.

Improvements in chemical control. LOUIS BAISSAC, *et al.* *Rev. agr. Maurice* **4**, 132-43 (1927).—Practically all the Mauritius sugar factories have some sort of chem. control, but even in the best of them the methods used leave much to be desired. Java and Hawaii get much better yields, because of stricter control; in Mauritius the results could also be greatly improved by the introduction of modern methods. It would pay to engage more chemists and to install a system of mutual control based on uniform methods.

F. W. ZERBAN.

The luminescence of sugar and sugar-house products. K. ŠANDERA. *Z. Zucker-ind. czechoslovak. Rep.* **51**, 237-45 (1927); *Listy Cukrovar.* **44**, 569 ff. (1925-6).—The soln. was placed in a test tube in a box, and was illuminated at an angle of 45° by ultra-violet light. It was viewed at 90° to the incidence of the ultra-violet. The intensity of the fluorescence was measured by inserting glass slips of equal thickness between the source and the sample until the sample matched a standard. Standard A was quinine-HCl, one part to two million parts of H_2O . Standard B (10% molasses) had a fluorescence 22 units greater than A, and was taken as zero in the work on sugar-house products. Detns. were made at several concns., plotted on log. paper, and extrapolated to 100° . Refined beet sugar had a fluorescence of 3 at 0.1%, rising in a smooth curve to 40 at 100% . Cane sugar showed higher fluorescence. Colonial sugar was higher

at low concns., passed through a max., and was lower (25-35) at 100°. Thirty samples of refined sugar were measured direct, but no correlation was found between fluorescence and ash (cf. Lundén, *C. A.* 20, 305). For the same sugar the finest fractions had a fluorescence of 10, while crystals of about 1 cu. mm. were as high as 40. Molasses absorbed ultra-violet, noticeably in layers 0.006 mm. thick, and 100% in a layer 5 mm. thick. This accounts for the low fluorescence of dark-colored sugars or fine grain. Refined sugar showed a noticeable phosphorescence 3-6 sec. after removing the source of ultra-violet light, raw sugars much less, and molasses none. The fluorescence of sugar-house products increases regularly from diffusion juice to molasses. Fusca coloring matter had no fluorescence. Colloids obtained from molasses by dialysis had a strong fluorescence in aq. or ether-alc. soln. The fluorescent substance may be obtained by extg. raw sugar or molasses with concd. AcOH, evapg. in vacuum, extg. with CHCl₃, evapg. to dryness, and extg. with Et₂O. A few drops of this soln. added to refined sugar causes a brilliant fluorescence. Simple condensation products of amino acids, also products formed by the action of alkali on invert, showed strong fluorescence. Thin sections of sugar crystals were examd. under the microscope and fluorescence was found only in the surface layers. Since, to a certain extent, fluorescence follows the non-sugars, the examn. of a sugar in this way may be of practical value. W. L. B.

Evaluation of sugar house products by measurement of fluorescence. HARALD LUNDÉN. *Z. Zuckerind. czechoslovak. Rep.* 51, 304-6. K. ŠANDERA. *Ibid* 323-4(1927).—Polenic regarding the above article. W. L. BADGER

Improved methods of sugar cane cultivation in North Bihar. WYNNE SAYER, KASANJI D. NAIK, AND HARDAVAL SINGH RANDHIROT. *Agr. J. India* 22, 5-16(1927).—Under Bihar conditions the sucrose content of the juice was increased 0.31-0.88% by planting the cane in October as compared with cane planted in February. K. D. J.

Purchasing cane. H. A. TEMPANY. *Rev. agr. Maurice* 4, 155-8(1927).—Cane is generally purchased in Mauritius on the basis of a fixed no. of kg. of sugar per ton of cane. Under these conditions the factories pay too much when prices are low, and too little when prices are high. The scale of prices should be revised; it would be best to establish a board appointed by the government which would det. equitable prices to be paid on the basis of the av. price for the campaign. F. W. ZERBAN

Starch in sugar cane. F. HADDON. *S. African Sugar J.*; *Rev. agr. Maurice* 4, 6-2(1927).—Starch occurs in such quantities in the Uba cane of Natal that it interferes with mfg. operations. But it is found only in cane from acid soils. Ripe cane contains less than immature cane. Even the unrefined sugars from such canes contain starch. The juices should be filtered, and hot maceration should not be used. Mn salts added to the soil do not prevent starch formation in the cane, but do increase the purity of the juice. F. W. ZERBAN

Steam distribution and economy, and the proportioning of pans in white sugar manufacture. L. J. COUTANCEAU. *Rev. agr. Maurice* 4, 173-98(1927).—To produce "extra fine" sugar, the capacity of the pans, crystallizers and centrifugals must be increased. Complete steam balances are worked out for various types of effects. Under the same conditions, the factory producing "extra fine" sugar requires 20% more steam than a raw sugar factory. With 12.25% fiber in bagasse, the latter requires no extra fuel, but the white sugar factory needs from 3 to 4.25% of cane, of wood, according to the evaporator equipment. Steam losses can be reduced in various ways. It is necessary to work with at least 6 pans, of equal capacity, 0.5 ton of massecuite per ton of cane per hr. F. W. ZERBAN

A technical study on the decomposition of invert sugar by lime. V. ČTYROKÝ. *Zuckerind. czechoslovak. Rep.* 51, 230-6(1927); *Listy Cukrovar.* 44, 501 ff.(1925-6).—Soln. contg. 0.3% invert and 15% sucrose was treated with CaO at diff. temps. and analyzed at frequent intervals. To stop action in the sample withdrawn it was dild. and neutralized with tartaric acid. At 21°, 2% of the invert was destroyed in 2 min.; the action was practically complete (96%) after 48 hrs. Levulose is decompd. more rapidly than dextrose. The rate of decompn. increases rapidly with temp., so that 50% is decompd. after 4 min. at 70°, and after 2 min. at 86°. When 1% of invert is present, 92% is decompd. in 9 min. at 86°. When CaO is added to pure sucrose solns. in the cold, heated slowly to 86°, and then invert added, more CaO passes into soln. and the rate of decompn. of invert is increased. W. L. BADGER

Date palm work in Kotchandpur. KALIDAS ROY. *Ann. Rept. Dept. Agr. Bengal* 1925-26, pp. 40-3(1927).—Expts. on the production of sirup and sugar from date-juice are briefly discussed. K. D. JACOB

The utilization of molasses. W. E. CROSS. *Rev. ind. agr. Tucumán* 17, 81-122

(1926).—The following are discussed: the value of molasses and markets for its sale; the use of molasses as an animal food and for the manuf. of alc.; alcohol as an internal-combustion fuel; manuf. of abs. alc.; denaturation of alc.; the by-products of alc. manuf. The manuf. of yeast, lactic acid and Ca lactate; molasses as a fuel; disposal of molasses which cannot be utilized.

MARY JACOBSEN

The principle of bagasse treatment with hot media. V. KHAISOVSKY. *Arch. Suikerind.* 35, 811-34(1927).—A brief sketch of the history of hot maceration is given. Two types of equipment which have lately been tried out in Java are described and illustrated. One of them has not been very successful in operation. The other, devised by Nobel, is being installed by other factories. Here the carrier between the last 2 mills is completely inclosed to prevent losses of heat and of material. It runs only one-fourth as fast as an ordinary carrier, and the bagasse layer is 4 times as thick. Hot H_2O is applied near the highest point of the carrier, next to the last mill. It passes through the layer of bagasse directly underneath, and the juice is caught in a small tank where it is reheated and limed. Then it is pumped back above the carrier to a point a little further removed from the last mill, and the entire operation is repeated several times. Finally the juice is used for imbibition. The macerator may be used not only in front of the last mill, but also in front of the one next to the last. It remains to be seen whether the increased extn. more than pays for the cost of operation. It appears strange that hot H_2O should do better than cold, because it has always been supposed that all the cells of the cane are ruptured by the heavy milling pressures used. Therefore, new plasmolysis expts. were made, with improved technic, and they have shown that bagasse contains many living cells. The expts. are illustrated by photomicrographs and microfilms. An explanation is offered for the presence of living cells, based on the mechanics of milling and taking into consideration also the hydrostatic pressure exerted by the extd. juice. About 25% of the total sugar in bagasse is contained in the living cells. This was proven by extg the juice from the open cells with cold H_2O , alternately applying vacuum and pressure in rapid succession. It follows that, to ext. all the sugar, it is necessary to kill the living cells by heating to at least 50° . In practice this is not easy to do, because heat penetrates bagasse very slowly. It would be best to agitate the bagasse in hot H_2O , or use other means by which the H_2O is thoroughly mixed with the bagasse. It would also be well to remove the air bubbles which keep the H_2O from entering the bagasse. The heat treatment might not be applied just to final bagasse, but directly after the 1st mill, or even after the crusher; here the use of steam may be preferable. The counter-current principle should be applied throughout. The heat treatment has the further advantage that it weakens microorganisms and enzymes. A no. of variations suggest themselves for the heat treatment of bagasse. It remains to be seen, however, how it will affect the mech. properties of the bagasse, as it is quite possible that treated bagasse may cause difficulties in milling. Suggestions are offered for the possible soln. of these problems also. A bibliography of 56 titles is appended.

F. W. ZERRBAN.

Technology of starch making. P. NOTTIN. *Rev. sci.* 65, 363-7(1927).—Brief discussion of the technology of the manuf. of starch from potatoes, with a plea for its scientific control, particularly as regards losses and their prevention.

A. P.-C.

Construction of a polariscope with photoelectric indication (STANĚK, ŠANDERA)
1. The commercial utility of tacuara cane (MAIDANA) 23.

Diffusion battery for extraction of sliced sugar beets. W. F. HOLZHEUER. U. S. reissue 16,739, Sept. 20. See original pat. 1,587,646, C. A. 20, 2593.

Starch product. D. J. BLOCK. *Can.* 272,898, Aug. 2, 1927. A starch conversion product comprises a mixt. of dextrinized acid esters of starch, mono- and polysaccharide starch sugars, amylose and polymers of amylose.

29- LEATHER AND GLUE

ALLEN ROGERS

Developments in the chemistry of leather manufacture during 1926. DONALD BURTON. *Leather Trades Year Book* 25, 84-99(1927).—A non-critical review, with bibliography.

Henry Richardson Procter. ETTORE ANDREIS. *Cuir tech.* 16, 400-2(1927).—An obituary.

H. B. MERRILL

H. B. MERRILL

Contribution of leather to the automobile. NORMAN HERTZ. *Ind. Eng. Chem.* 19, 1104-5(1925).—A discussion of the manuf., and properties of, and specifications for upholstery leather, particularly that used in automobiles. H. B. MERRILL

Tanniferous plants of Madagascar. CARLE. *Cuir tech.* 16, 379-85 et seq.(1927); cf. *C. A.* 21, 1389.—Description of, and analytical data for, a large no. of species, are given. H. B. MERRILL

Tanning materials of Australia. D. COGHILL. *Australian Council Sci. Ind. Research, Bull.* No. 32, 5-138(1927).—A very extensive study of the entire flora of Australia from the point of view, economic and technical, of tannin production. Analyses of over 800 samples, from 221 species, are given. No new materials of com. importance have been discovered. H. B. MERRILL

Technic of tannin manufacture. F. CHEMNITUS. *J. prakt. Chem.* 117, 83-96(1927); cf. *C. A.* 21, 2166.—A description of methods and app. for extn. of tannic acid from oak galls and similar material. H. B. MERRILL

Preliminary report on the treatment of redgum or marri kino (*Eucalyptus calaphylla*) for the preparation of tanning extract. D. COGHILL. *Australian Council Sci. Ind. Research, Circular* No. 9, 1-14(1927).—After treatment with hot aq. $\text{Na}_2\text{S}_2\text{O}_8$, alone or mixed with Na_2SO_3 , either at atm. pressure or in an autoclave, marri kino dissolves in hot H_2O forming a stable soln. The resulting ext. (best sample) contained H_2O 10%, insol. matter 1.2, sol. tannin 61.8, sol. non-tannin 27, ash 6.1%. The product resembles quebracho. H. B. MERRILL

The preparation of quebracho extracts. G. BALDRACCO. *Boll. industria pelli* 4, 187-90; *Chem. Zentr.* 1926, II, 854.—The heart of quebracho wood contains 20% tannin, the sap-wood 2.2% and the bark 4.5%. The ext. is now produced chiefly in Argentina. Its water content should not exceed 22%. The literature on its production, research and commerce is given. C. C. DAVIS

Hide powder. W. R. ATKIN AND F. C. THOMPSON. *J. Intern. Soc. Leather Trades Chem.* 11, 300-8(1927).—In the manuf. of hide powder from skin, collagen inevitably undergoes some degradation, the extent of which varies in different batches. With degradation, the no. of open COOH and NH_2 groups increases. At any p_H value higher than the isoelec. point, hide powder is combined with alkali. The quantity of alkali so held increases with the no. of free COOH groups—i. e., with the "degradation." Upon treatment with tannin soln., this alkali combines with the non-tans, and passes into the filtrate, causing the wt. of non-tans found to be high. Variations in the extent of degradation are thus the cause of variations in analytical results yielded by different batches. These differences can be overcome by bringing all batches to p_H 5.5, where the combined alkali is practically nil. H. B. MERRILL

Acid determination in tan liquors by means of dialysis. O. L. STEVEN AND E. WACKER. *Collegium* 1927, 300-1; cf. *C. A.* 18, 2264.—Ten cc. of the liquor is placed in a 16×100 mm. diffusion thimble (S&S 579) and suspended overnight in a beaker contg. 150 cc. of water. A second extn. for 5 hrs. is then made. The dialyzates are treated to phenolphthalein with 0.1N NaOH. There is no color interference. I. D. C.

The mechanical analysis of leather. G. POVARNIN. *Collegium* 1927, 125-47.—The no. of samples required for a given accuracy and the location from which they should be taken are discussed in detail. The work of Gubarew, Bobarykow and Kopeliowitsch on sampling and the effect of moisture content on phys. properties is reviewed. I. D. C.

Stalagmometric examination of some fats of the leather industry. WILHELM SCHÜLLER. *Collegium* 1927, 288-300.—Results by the drop weight method are given, showing the influence of temp., NaOH, NaHCO_3 , soap and sulfonated oil on the interfacial tension between oil and water. Fish liver, neatsfoot, olive and vaseline oils were used. The following quant. sepn. is suggested: Shake out with alc. contg. a little KOH. The residue is unchanged fat. The alc. extd. after treating with a little AcOH is extd. with petroleum ether to sep. fatty acids, then with CHCl_3 or CCl_4 to remove sulfofatty acid. I. D. C.

Purification of tannery sewage. DIENERT. *Cuir tech.* 16, 376-8(1927).—A description of the process employed in the Griess-Pfleger tannery, Chicago. H. B. M.

Anthrax. R. H. PICKARD. *Leather Trades Year Book* 25, 80-3(1927).—Anthrax bacilli and spores occur most often in dried, seldom in salted, skins. The methods proposed for disinfection include treatment in the soak with acid, alkali, and specific bactericides. The latter method is ineffective, as the disinfectant usually combines so rapidly with the skin that complete sterilization is almost impossible of attainment.

The first 2 methods are effective, but likely to cause damage to the skin. A good sterilization method involving neutral solns. is much to be desired. H. B. MERRILL

Measurement of the adhesive strength of glue. C. E. LANYON. *Ind. Eng. Chem.* 19, 1191-3 (1927).—Briquets made from 400 g. of 40-mesh Al oxide and 60 g. of 60% glue soln., and then dried 6 weeks in air at 60% relative humidity and 25°, were broken in a Richlé testing machine. Tests were duplicated within 2%. The max. briquet strength was at p_H 7.5. There is no parallelism between viscosity, tensile strength, briquet strength, or jelly strength. "The results point to the existence of wide differences in the adhesive strength of glues of the same grade obtained from different manufacturers. This, as well as the results of over 200 other tests (not given here), shows the futility of relying on viscosity or jelly strength measurements alone for testing the suitability of glues for joints of the specific type." It is not yet detd. whether these differences are due to variations in the raw hide stock, or in mfg. methods. J. A.

The rapid viscometer of Klever for glue and gelatin. GUSTAV GÜNTHER. *Chem.-Ztg.* 51, 526-7 (1927).—The Klever viscometer consists of a measuring pipet with metal capillary surrounded by a heating bath up to 100°. The actual detn. takes around 1 min.; only 30 cc. soln. is required. The accuracy is about 0.02 to 0.03 Engler degrees for a viscosity around 4 to 5. B. J. C. VAN DER HOEVEN

Composition of leather and rubber (Brit. pat. 261,879) 30. Preheater and evaporator for concentrating tanning liquors (Brit. pat. 262,608) 1.

Imitation leather. G. A. SALLMANN. Brit. 262,783, Dec. 8, 1925. A fabric suitable for use in the manuf. of gloves, after dyeing and as a last stage in its treatment, is passed while dry through rubber pressure rolls which give it a smooth-mat surface.

Artificial leather. P. MAGNUS. Can. 273,283, Aug. 23, 1927; Brit. 263,004, Mar. 22, 1926. Cleaned scrap leather, in a proportion of approx 25%, is added to a heated incorporated mixt. of glue 70, glycerol 12.5, boiled linseed oil 10, carbolic oil 2.5, $(NH_4)_2Cr_2O_7$ 2.5 and $CaCl_2$ 2.5%; the mass is subjected to suitable pressure subsequent to the blending.

Enameled leather. C. P. KELLEY and E. W. WHITE. Brit. 262,780, Dec. 8, 1925. Successive coatings are used which may be formed of linseed oil, pyroxylin, naphtha and coloring materials such as powd. Al or bronze powder which may differ in the different coatings.

Waterproof material for shoe soles, etc. A. F. E. DE ST. DALMAS. Brit. 261,028, Dec. 15, 1925. Material suitable for use as an insole comprises leather or fabric coated or impregnated with plaster of Paris and adhesives such as rubber, gum, dextrin, resin, pitch and wax or oleaginous substances.

Treating hides. F. W. WEBER. U. S. 1,642,054, Sept. 13. Hides are treated with NaCl and a soln. of a rare earth compd. other than Ce, e. g., with chlorides of rare earth metals in the presence of soap, to produce a soft-white leather.

30—RUBBER AND ALLIED SUBSTANCES

C. C. DAVIS

The spiral structure of rubber and the relative saturation capacity of shell aggregates. HEINRICH FEUCHTER. *Kautschuk* 1927, 98-101, 122-4; cf. C. A. 21, 1898, 1902, 1903.—The structure of the latex particle and of rubber gel is an unsatd. shell aggregate produced by the eccentric spiral binding of valences, similar to the crystal structure with diagonal screw axes deduced by Weissenberg. Amorphous colloids and amorphous crystalloids are unsatd and satd shell aggregates, resp., proceeding from eccentric and concentric spiral structures. The formation of a fiber structure in racked rubber may be considered as an anisotropic phase crystn. which progresses by linear arrangement of disperse mol. chains or threads. This idea, illustrated by diagrams, may be extended to account fully for highly racked rubber, which is insol. and does not swell, and for the reversibility of stretching and racking. G. I. CLARK

Ultramicroscopic studies of the theory of vulcanization. H. DANNENBERG. *Kautschuk* 1927, 104-5, 128-30.—By refined technic, D. was able to observe thin transparent layers of rubber mixts. under the ultramicroscope at temps. up to 160° at a magnification of 240. The mixts. were 100 parts light crepe, 5 S and 100 crepe, 5 S, 1 ZnO and 1 accelerator (diphenylguanidine or Vulkazite P). By warming at 60°, the S first dissolves in the rubber; in the mixt. with 5% S all dissolves at 95°. The soln. and

dispersion take place with a rapidity which discountenances the theory that S melts. When the soln. so obtained is heated to a higher temp., a colloidal substance separates at 120° for unaccelerated mixts. and at lower temps. for accelerated. The beginning of vulcanization coincides with this colloidal sepn. By longer heating at the vulcanization temp., further increased sepn. does not ensue, but the colloidal particles form small chains. Upon cooling part of the S separates, usually as spheres of solid amorphous S with diams. of 5 to 50 μ . These and other exptl. results are interpreted to indicate that vulcanization is accompanied by the transformation $S_A \rightarrow S_\mu$ and the sepn. of colloidal S_μ . Accelerators are substances which accelerate the transformation. Vulcanized rubber is a colloidal system in which raw rubber is the dispersion medium and S_μ is the dispersum. Superficially this theory does not seem to account for the fact that vulcanized rubber is insol. in org. solvents. There are many colloid examples, however, which prove that the soly. of a substance in the colloidal state is far less than in the massive state; e. g., colloidal Au unamalgamated by Hg; the insoly. of Ag of the photo-chloride in dil. HNO₃. A good analogy of raw and vulcanized rubber is that of Fe and steel. In both cases the addn. of a second highly dispersed phase results in an increase in elasticity and an increased resistance to chem. attack.

G. L. CLARK

Review of works on the chemistry and technology of rubber for the year 1924.

B. RUIZOV. *J. Chem. Ind. (Russia)* 1, No 3, 24-8 (1925); *Chem. Zentr.* 1926, II, 829.

C. C. DAVIS

Foreign patents of interest to the rubber trade. ANON. *India Rubber & Tire Rev.* 27, No. 8, 58 (1927).—A list of recent German, Canadian, French, Austrian, Czechoslovakian, Dutch and Swiss patents.

C. C. DAVIS

The use of the chemical washing process in the rubber industry. GEORG WEISSBERGER. *Kautschuk* 1927, 222-5, 248-51 (1927); cf. *C. A.* 21, 2816.—The phys. and chem. principles involved, vapor pressure curves of binary mixts. and an illustrated description of the technic and app. for large-scale operation are included. C. C. D.

The constitution of rubber. RUDOLF PUMMERER. *Kautschuk* 1927, 233-6.—A summary, describing in a brief way several fields of investigation, the results of which have not previously been published. To purify rubber, latex was let stand 16 hrs. at 60° with 20% NaOH, the hydrocarbon removed, the process repeated, the NaOH removed by dialysis, and the product fractionated by exhaustive extrn. with Et₂O. The purified rubber still contains impurities which can be detected by optical means. The gel-rubber is the component responsible for the toughness of rubber and the sol-rubber for the elasticity. When gel-rubber is dissolved in C₆H₆ and pptd. with EtOH, it becomes partially sol. in Et₂O, and becomes more completely sol. if basic or acidic substances like piperidine, EtNH₂, NH₃ or AcOH are added. Furthermore mastication of gel-rubber in CO₂ renders it sol. in Et₂O. This suggests that the mol. chain can be ruptured by mech. means though this disaggregation is colloidal or crystallographic, i. e., intramol. rather than intermol. When not stretched, neither gel-rubber nor sol-rubber show any x-ray evidence of crystal., but like ordinary rubber they show interference points when stretched. Disaggregation and aggregation are reversible, for among the fractions obtained by evapg. an Et₂O soln. of rubber are found, after standing, traces of gel-rubber insol. in Et₂O. This gel-rubber is rapidly disaggregated by piperidine or NH₃. This slow process of aggregation involves the gradual formation of intramol. colloid.-chem. or cryst. arrangements, with accompanying changes in soly., which is to be distinguished from association. Gel-rubber and sol-rubber probably have the same structural mol., and both these and diffused rubber were found to have mol. wts. of 1000-1600 by the Rast-camphor method. With menthol, in which rubber is readily sol. without swelling, the mol. wts. were 1200-1600 for 2% solns., but only 600 for 0.5-1% solns., the latter value being of significance in connection with a similar value also obtained during hydrogenation expts. and suggested by Hauser and Mark from osmotic studies. Detsn. of the osmotic pressure and the diffusion of dil. C₆H₆ solns. of rubber indicated mol. wts. of 30,000-50,000, and yet sol-rubber can be dialyzed from its C₆H₆ soln. Rubber probably has a parent mol., which by aggregation and disaggregation, association and disassociation, accounts for the various phenomena. The probable org. chemistry of this parent mol. is discussed.

C. C. DAVIS

The constitution of highly polymerized compounds, particularly rubber. H. STAUD-
Kautschuk 1927, 237-8.—A discussion in answer to a paper by Pummerer (preceding abstr.), and based for the greater part on previous publications of S. (cf. *C. A.* 21, 1271; *Kautschuk* Aug.-Sept., 1925). Reply by PUMMERER. *Ibid* 238.—Discussed by STAMBERGER. *Ibid* 238.

C. C. DAVIS

The oxidation of rubber from the scientific and from the technical standpoint

F. KIRSCHOF. *Kautschuk* 1927, 239-45, 256-61.—An elaboration of an abridged article appearing elsewhere (cf. C. A. 21, 3141) which describes a wide field of experimentation. The rate of oxidation of vulcanized rubber in ultra-violet light and air or O increases with the time of vulcanization, and is also greatly increased by extn. with Me_2CO . Furthermore, it varies greatly with the kind of rubber, vulcanized crepe oxidizing far more rapidly than vulcanized Para rubber, probably because ultra-violet light penetrates the former much more readily. The difference in the rate of oxidation of unextd. and extd. vulcanized rubber is probably closely related to the condition of the S and to the absorption of ultra-violet light, for it is known that ultra-violet light is completely absorbed by a vulcanized mixt. which reflects it before vul. anization and that CS_2 contg. S absorbs ultra-violet light, while CS_2 alone transmits it. This suggests a means of detg. whether S is chem. combined or in soln., and indicates that chem. combination occurs during vulcanization. The primary yellow products of oxidation in ultra-violet light are converted by boiling dil. H_2SO_4 to the same brown substances which are obtained on oxidation at 70° in darkness. The immediate onset of oxidation in ultra-violet light is in contrast to the induction period in O. The gain in wt. occurring during oxidation in ultra-violet light ceases long before the O reaches the proportion represented by $\text{C}_6\text{H}_8\text{O}$. Extensive tests on the sp. influence of different compds. on aging are merely summarized, but serve to show that Fe, Cr, Pb, Sn, Zn, Cu and Mn differ in their action, and that the influence of any particular metal depends upon the negative radical, i. e., upon the particular salt. The rate of oxidation of vulcanized rubber in O at 70° is about double that in air at 70° , and in ultra-violet light and air at $40-45^\circ$ it is about 3 times that in air in 70° in darkness. For the ready detn. of small differences in the state of cure and for testing antioxidants, oxidation in ultra-violet light and air is considered the best artificial test. Less pronounced differences in quality, which depend upon the rubber resins, accelerators and after-vulcanization, can be studied better by an artificial test in air or O at 70° . There is a marked difference in the chem. and phys. properties of the oxidation products of low and highly cured rubber. Thus the yellow, sticky Me_2CO -sol. oxidation product of rubber cured a short time gives a positive pyrrole test, while the red-brown, shellac-like Me_2CO ext. of the same rubber at a much longer cure gives a negative test. The Me_2CO ext. of the oxidized rubber increases in its degree of acidity and its intensity of color with the time of cure. The % Me_2CO ext. of oxidized rubber and the swelling power in Me_2CO of the insol. residue increase to a max. at a certain cure and then decrease as the cure progresses. C. C. DAVIS

New trends in the x-ray spectrography of rubber and rubber-like elastic substance. The amorphous rings and their changes during stretching. J. R. KATZ. *Chem.-Ztg.* 51, 381-5(1927).—K. first reviews all information concerning the significance of the broad, diffuse diffraction rings obtained with liquids and other amorphous substances. Keesom first gave explt. evidence that in liquids the interferences measure the av. sepn. of mols. If these are considered as spheres, the x-ray spacing a should agree with $b = 1.33 \sqrt{M/d}$. This is true only for truly spherical mols. and for the lower members of the normal aliphatic compd. series. Longer-chain compds. give approx. a const. dimension of 5.6 A. U. The diam. of the broad ring for substances with side chains, such as triolein, agrees with that for the side chain alone (oleic acid). The diams for unpolymerized and polymerized substances are the same, but a new inner ring appears for the latter, corresponding to the a part of the middle points of the large aggregate. Following are some measurements on the principal ring: heat polymerized erythrene rubber 28.3 mm., 5.6 A. U.; erythrene 28.5, 5.6; dimer (6-membered ring) 25.0, 6.3; heat polymerized isoprene rubber 26.1, 6.0; isoprene 26.2, 6.0; dimer 23.2, 6.7; Me-rubber 23.4, 6.7; dimethylbutadiene 24.2, 6.5; dimer 21.8, 7.1; Hevea rubber 26.1, 6.0; rubber from other plants 26.1, 6.0; cyclo-rubber 22.6, 6.9; hydro-rubber 26.0, 6.0. The last value shows that H attaches at double bonds without changing the dimensions, while cyclo-rubber is distinctly different. Upon stretching, synthetic rubbers produce diagrams similar to that of gelatin in that the broad amorphous ring broadens and intensifies at right angles to the direction of elongation. Heat-polymerized Me-rubber, glass-clear and unmastered, produces 2 cryst. interferences on the equatorial line, in addn. to the above. These phenomena all indicate a transition state between amorphous and cryst. G. L. CLARK

From coal to rubber. FRITZ HOFMANN. *Mitt. Schlesischen Kohlenforsch. Kaiser-Wilhelm Ges.* 2, 235-48(1925); *Chem. Zentr.* 1926, II, 830-1.—An address. All research directed toward the synthesis of rubber is based on isoprene, which is obtained in small quantities as a decompn. product in the distn. of rubber. In work covering 2 yrs., a technical process for the prepn. of isoprene was developed, and by heating under pressure the isoprene was polymerized to rubber. The latter could then be decompd. to

the same products as those obtained by Harries by the action of O_2 on natural rubber. The synthesis of rubber from coke through CaC_2 , C_2H_2 , AcH , $AcOH$, Me_2CO , $NaOEt$, 1, 3-butanol, butanol and β -methyl-1, 3-butadiene is described. Reference is also made to methyl-rubber, which was used technically during the war. The quality of synthetic rubber was found to be excellent for the manuf. of hard rubber goods, but unsatisfactory for soft rubber goods. C. C. DAVIS

Nature of maturated slab rubber and the accelerating power of potassium salts. C. C. DAVIS. *Rubber Age* (N. Y.) 21, 453, 458(1927).—An English commentary version of an article by Bruni and Levi (*C. A.* 21, 2815). C. C. DAVIS

Rubber-filler systems. A contribution to the colloid problems of the rubber industry. P. STAMBERGER. *Kolloid-Z.* 42, 295-300(1927); cf. Klein and Stamberger, *C. A.* 19, 1064.—When thoroughly milled rubber is mixed with a filler and the mixt is immersed in a solvent, all of the rubber and part of the filler disperse throughout the solvent, the remainder of the filler forming a sediment. The proportions dispersed and pptd. and the time required depend upon the filler and its quantity, the higher the filler content in the rubber, the less the proportion dispersed and the more pptd. Furthermore these proportions, which are peculiar to each filler, bear no relation to the particle size or to the d. of the filler, and the rubber must have a sp. action, *absorption* probably occurring. The following values are the % filler dispersed under typical const. conditions: ZnO 98, $BaSO_4$ 0.4, kaolin 2.0, PbO 44.1, MgO 44.0, $MgCO_3$ 87.5, C black 100. With C black, adsorption probably involves the formation of a new gel structure, the structure of the original rubber, which has been destroyed by milling, being in effect restored. C. C. DAVIS

Rubber as a dielectric material. ST. REINER. *Kautschuk* 1927, 261-3.—A general discussion, with particular reference to the controversy over the V.D.E. specifications (cf. Esch and Miosga, *C. A.* 21, 2818). C. C. DAVIS

The electrodeposition of rubber and the anode process. H. P. STEVENS. *Bull. Rubber Growers' Assoc.* 9, 514-6(1927).—A concise review of the development of the anode process and the principles involved. C. C. DAVIS

Rubber-insulated conductors for high currents and the specifications of the V. D. E. PAUL MIOSGA. *Gummi-Ztg.* 41, 2371-2(1927).—Further discussion (cf. *C. A.* 21, 2818). C. C. DAVIS

Spreading doughs and adhesive solutions. WERNER ESCH. *India Rubber J.* 74, 293-4(1927).—An English version of *C. A.* 20, 3839. C. C. DAVIS

Carbon black produced from natural gas in 1926 (HOPKINS) 18. Preparation of aldehyde-ammonia (SOROKIN) 18. Paving blocks comprising rubber (U. S. pat. 1,642,846) 20. Floor covering (U. S. pat. 1,642,845) 20. Carbon black (Can. pat. 272,468) 18. Reaction products from cashew-nut shell oil (Brit. pat. 262,134) 27. Sectional rubber pavement (U. S. pat. 1,643,024) 20.

Synthetic rubber. W. O. HERRMANN and W. HAEHNEL. Can. 271,571, June 14, 1927. Polymeric vinyl compds. are treated with S compds.

Porous rubber. H. BECKMANN. Brit. 262,179, Sept. 2, 1925. Latex is coagulated to a homogeneous cohesive jelly which is then vulcanized without allowing it to become dry. Coagulation may be effected with SO_2 or by adding alum, $ZnSO_4$, $FeCl_3$ or like substances to form a thick, paint-like pulp and then coagulating with liquid or viscous acid. Cf. *C. A.* 21, 3141.

Rubber compound. A. B. COWDERY. Can. 271,759, June 21, 1927. In the compounding of rubber, rubber stock is mixed with a tar-distn. residue contg. about 60% of uncombined C and 40% high-boiling hydrocarbons. Cf. *C. A.* 20, 3842.

Rubber emulsion. W. B. PRATT. Can. 271,797, June 21, 1927. Rubber is dispersed in non-aq. substances which are non-solvents of rubber by first incorporating a colloid in a rubber mass and then mixing the rubber-colloid mixt. with the non-solvent substance at a temp. at which the substance is sufficiently liquid for such purpose.

Rubber articles. C. W. AVERY and D. O. MOODY. U. S. 1,642,666, Sept. 20. Articles such as steering wheel rims are made with a core of fibers and rubber, and with a casing of rubber, all vulcanized.

Rubber conversion product. H. L. FISHER. U. S. 1,642,018, Sept. 13. Rubber is heated with trichloroacetic acid and a phenol to produce a thermoplastic material suitable for making molded articles, waterproof coatings, etc.

Rubber substitutes. CONSORTIUM FÜR ELEKTROCHEMISCHE INDUSTRIE GES. Brit. 261,748, Nov. 23, 1925. Polymerized vinyl alc., or a deriv. or homolog such as an

ether, ester or acetal, is heated with S or a S compd. such as S monochloride. Catalysts or vulcanization accelerators may be added, *e. g.*, piperidine.

Curing hollow rubber articles while filled with heated water. R. R. JONES. U. S. 1,642,614, Sept. 13.

Apparatus for curing hollow rubber articles with steam. R. W. BROWN. U. S. 1,643,196, Sept. 20.

Thermoplastic rubber derivative. H. GRAY. Can. 273,208, Aug. 16, 1927. *p*-Toluenesulfonyl chloride is caused to react with comminuted vulcanized rubber scrap under such conditions as to produce a heat-plastic product.

Composition of leather and rubber. R. MEYER. Brit. 261,879, Sept. 28, 1925. Dried disintegrated leather waste is incorporated with rubber soln. to form a paste which is kneaded and used for making molded articles which may be vulcanized by the addn. of a suitable vulcanizing agent to the compn.

Treating latex. K. D. P., LTD. Brit. 262,487, Dec. 7, 1925. Fillers are incorporated in untreated, stabilized, thickened or vulcanized latex, without coagulation, by adding equiv. proportions of sol. materials which react and ppt. solid particles in the latex, *e. g.*, $(\text{NH}_4)_2\text{SO}_4$ soln. may be added to a mixt. of S, ZnO and latex paste, followed by the addn. of $\text{Ba}(\text{OH})_2$ soln. to ppt. BaSO_4 . Lithopone, CaCO_3 , silicic acid, Ca oxalate and BaCO_3 also may be used as fillers.

Vulcanizing rubber. H. W. ELLEY and D. H. POWERS. U. S. 1,643,205, Sept. 20. An accelerator is formed by the combination of a nitrosodialkylaryl-amine such as *p*-nitrosodimethylaniline and *n*-butylamine or other aliphatic amine, which may be caused to react in alc.

Vulcanizing rubber. L. B. SEBRELL. Can. 272,862, Aug. 2, 1927. The vulcanization of rubber is accelerated by an aminopolyhydroxy aryl condensation product. Cf. C. A. 21, 1031.

Composition for uniting rubber. R. M. WITTHYCOMBE. Can. 272,308, July 12, 1927. A compn. for applying to metal or other objects consists of a vulcanizable rubber soln. to which is added about 5-10% asphaltum.

Composite yarns of ramie or rhea and artificial silk (for use in making pneumatic tires). DUNLOP RUBBER CO., LTD., W. H. PAULL and R. TRUESDALE. Brit. 262,256, Nov. 28, 1925.

Apparatus for making sheet material of rubberized fiber. P. BEEBE. U. S. 1,642,008, Sept. 13.

Impregnating and vulcanizing fabric. D. F. HENNESSY. U. S. 1,642,546, Sept. 13. A rubber soln. and a vulcanizing agent such as H_2S and S chloride are simultaneously forced into a fabric so that the fabric is impregnated as the rubber is vulcanized.

Vulcanizing tire casings. G. H. ELLINWOOD. U. S. 1,642,541, Sept. 13. Mech. features.

Di-*p*-xylylguanidine. W. SCOTT. U. S. 1,642,180, Sept. 13. This compd. is an accelerator of rubber vulcanization, m. 170-170.5°, and is made by reaction of NH_3 or NH_4OH with di-*p*-xylylthiorea in the presence of PbO or other basic Pb compd.

CHEMICAL ABSTRACTS

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No. 22

1—APPARATUS AND PLANT EQUIPMENT

W. L. BADGER

The rotary kiln and its operation. SCHUSTER. *Chem.-Ztg.* **51**, 666-7, 708-10, 727 8(1927).—S. discusses the methods of feeding, refractory linings, accumulation of deposits on the walls of a kiln, the foundation, etc. In most modern practice the kiln is inclined at a gradient of 4-5% with the horizontal. It is built widest at its mid-section (calcination zone) to permit thorough and uniform heating of the charge before it enters the hottest zone. To dry a new kiln requires at least 8 days heating with a small fire. On the last day the temp. must be kept above 100° to prevent condensation of water vapor. Gas and oil are replacing coal firing.

DAVID GORDON

Hempel gas apparatus without absorption bulbs and its use in the examination of commercial oxygen. R. C. FREDERICK. *Analyst* **52**, 400-1(1927).—A simple modification of the Hempel app. is suggested that can be used in some cases. The measuring buret has a simple stopcock at the top and a 3-way stopcock at the bottom. At the bottom connection is made to the leveling buret and also independently to a separatory funnel. Directions are given for using this simplified app.

W. T. H.

A circulating gas system for exact gas analysis. P. RASSEFELD. *Gas u. Wasser-fach* **70**, 949-51(1927).—App. is described by means of which a large vol. of gas may be measured with a high accuracy and automatically circulated over the desired absorbing reagent.

R. W. RYAN

Apparatus for determining water vapor in gases. H. STRACHE AND J. CARMANN. *Feuerungstech.* **15**, 121-2(1927); cf. *C. A.* **17**, 1879.—By immersing the sampling container in the gas, a sample is taken at the (known) temp. of the gas. The container is then immersed in cold water of known temp., and the vol. of water drawn in on opening a cock is noted. The water vapor content can then be computed.

E. W. T.

An interferential dilatometer employing automatic photography. R. H. SINDEN. *J. Opt. Soc. Am.* **15**, 171-7(1927).

E. J. C.

Measuring colors in industry. Photo-colorimetry, a method independent of the eye. ANON. *Rev. gen. mat. color.* **31**, 287-93(1927).—A description is given of the construction and use of the T. C. B. photo-colorimeter.

L. W. RIGGS

A simple colorimeter. R. C. FREDERICK. *Analyst* **52**, 469-70(1927).—The instrument is provided with 2 colorless and graduated tubes placed close together under and over reflecting mirrors and connected by rubber tubing with 2 reservoirs which can be raised or lowered. The images are observed in the upper mirror and after filling one reservoir with the unknown soln. and the other with the standard, the 2 are raised or lowered until the 2 images match.

W. T. H.

A micropyrometer. H. v. WARTENBERG AND H. MOEHL. *Z. physik. Chem.* **128**, 445-8(1927).—A pyrometer was constructed using a lens of short focal length giving a small image magnified 100 times by a microscope. The total length of the pyrometer is 20 cm. The pyrometer can be used with a min. object distance of 8 cm. Constructional details and a diagram, and calibrations for various object distances are given.

ROBERT F. MEHL

An apparatus for the adjustment of x-ray cameras. A. K. BOLDUIREV. *Z. Arch.* **65**, 117-8(1927).—A description of a tube and mirror to make the adjustment of the x-ray beam easier and to avoid exposure of the eyes.

L. S. RAMSDALL

Rapid extraction. A. G. KUHLMANN. *Z. anal. Chem.* **72**, 20-7(1927).—An app. shown which is suitable for the extrn. of substances in quant. analysis and weighing the residue. The bottom of a glass vessel is provided with a glass filter plate and 2 glass covers for both the top and bottom. The use of the app. is illustrated by 10 of typical analyses, the results of which compare favorably with those obtained the usual Soxhlet extrn.

W. T. H.

Surface tension balance. E. L. WARREN. *Phil. Mag.* [7], **4**, 358-86(1927).—The method used is a modification of Jaeger's method, and has been designed primarily

for the exptl. detn. of the temp. coeff. of surface tension, and for the investigation of the dependence of the surface tension of solns. on their concn. The chief feature of the method is that it enables all such measurements to be expressed in terms of the surface tension of some appropriate standard liquid such as water. The app. consists of 2 small circular jets of the same cross-section, which are in gaseous connection with each other. The jets are immersed separately in the liquids to be measured. The air in the bottle supplying the gas pressure is maintained at a pressure of a few mm. of Hg above that of the atm. A pinch-cock is opened until bubbles of gas escape at intervals of about 5 sec. from one of the jets. The depth of immersion of one of the jets is adjusted until the bubbles escape approx. alternately from the 2 jets. This arrangement enables the surface tension of the liquid in the one beaker to be balanced against that of the liquid in the second beaker. The balance is independent of the pressure maintaining the bubble system. In order that this may be so it is essential that the 2 jets should be identical in size and shape. The surface tension of H_2O is detd. as a function of temp. and of $NaCl$ as a function of concn. GEORGE GLOCKLER

The surface energy and heat of solution of sodium chloride. II. A new type of adiabatic calorimeter. S. G. LIPSETT, F. M. G. JOHNSON AND O. MAASS. *J. Am. Chem. Soc.* 49, 1940-9(1927). The app. described in a previous paper (C. A. 21, 3814) has been improved so that the $NaCl$ is kept dry before soln., and the previous work has been checked with greater accuracy. J. H. MOORE

Design of a constant-temperature moist closet. W. F. PURKINGTON. *Public Roads* 7, 250-1(1927). A. E. GRAY

Copper-constantan thermocouples and the hydrogen thermometer compared from 15° to 283° absolute. W. F. GIAUQUE, R. M. BUFFINGTON AND W. A. SCHULZE. *J. Am. Chem. Soc.* 49, 2343-54(1927).—A H thermometer was prepd. and calibrated and the thermocouples were compared with it and with each other. Advantages are pointed out of such thermocouples particularly in connection with continuously calibrated fixed-resistance thermometers for low-temp. work. A. P. SACHS

Hydrogen gas thermometer compared with the oxygen and hydrogen vapor-pressure thermometers by means of a copper-constantan thermocouple. W. F. GIAUQUE, H. L. JOHNSTON AND K. K. KELLEY. *J. Am. Chem. Soc.* 49, 2367-72(1927).—A Cu-constantan thermocouple (cf. preceding abstr.) was compared with O and H vapor-pressure thermometers with complete agreement with O, and also with complete agreement with H down to $25^\circ K.$, below which error is caused apparently by adsorption of H in the thermometer. A. P. SACHS

A new apparatus for determining the thermal expansion of solid bodies. HOFFMANN. *Glasindustrie* 34, 84(1926).—The expansion of the test piece is compared with that of a quartz rod. Samples up to 100 mm. long may be used. By means of a reflecting prism resting upon both test piece and quartz rod and an auto-collimating telescope expansion measurements are made. An accuracy of 0.5% is claimed. H. F. K

A new form of thermostat and observation tubes for polarimetric work. T. S. PATTERSON. *J. Chem. Soc.* 1927, 1717-20.—The polarimeter tube in its support of flanges and rods, of which there is a detailed description and sketch, is placed so as to be in direct contact with the liquid in the thermostat. For work at 0° or lower, an arrangement has been devised whereby a slow current of air is circulated near the end plates to prevent a deposit of moisture on them. Thus a clear view through the polarimeter tube may be obtained. The device is efficient even when a freezing mixt. of CO_2 and alc. is used as cooling agent. The app. gives accurate results, is easy to manipulate, can be used for a wide range of temps., is quickly adjustable to the desired temp., and can be maintained within about $1/10$ of a degree of the desired value for a long period of time. RUBY K. WERNER

Laboratory apparatus for the electrolytic preparation of oxygen and of ozone. O. R. WULF. *J. Optical Soc. Am.* 15, 119-24(1927).—The O_3 generator is an electrolytic cell contained in a 5-l. glass jar; the electrolyte is dil. H_2SO_4 . A Pb collar of large diam., which serves as the cathode, is suspended by Pb arms from the edge of the jar. The anode is contained in a glass guard-tube which is passed down through the electrolyte and makes a complete turn, coming up under a glass bell in which the O_3 rises. The anode is made of a small Pb cylinder cast around a sharp bend in a piece of small Cu tubing. This generator has been used with loads up to 12.5 amps., and concns. up to 3% by vol. of O_3 have been obtained. In the O_2 cell, which is of the same general appearance as the above, the electrodes are of sheet Ni, and the electrolyte is a 12% soln. of pure NaOH in distd. H_2O . CO_2 from the air is not excluded from this cell. J. H. PERRY

A new mercury volumeter. E. J. WHEELER AND A. H. KUECHLER. *J. Am. Ceram. Soc.* 10, 807-12(1927).—Lowering a piston into a Hg well submerges the test piece and the displaced Hg is forced into a buret. C. H. KERR

Continuous centrifugals. OTTO PANKRATH. *Centr. Zuckerind.* 35, 274-6, 302-4, 330-1(1927).—A general discussion. W. L. BADGER

New theory for the centrifugal pump. A. F. SHERZER. *Proc. Am. Soc. Civil Eng* 53, 1775-1803(1927). E. J. C.

Industrial furnaces. V. J. AZBE. *Mech. Eng.* 49, 1079-81(1927).—A furnace must be divided into heat-generating and heat-absorbing portions, when the overall efficiency is to be detd. Curves show the efficiency of a boiler as a heat absorber, and the sensible heat loss with different terminal temps. of gas leaving the furnace, with oil as fuel: when burned with no excess air; no loss of heat by radiation; and no steam used for oil injection and atomization. The greatly increased loss of heat in the products of combustion with higher terminal temps. is emphasized in a curve. The effect of excess air and incomplete combustion, and the effect of various amts. of steam in a gas producer on loss of efficiency and capacity of lime or cement kiln are shown. Fuel oil, next to natural gas, is the ideal industrial furnace fuel. The necessity for speed in attaining furnace temps. and the ability to vary at will and within narrow limits the atm. required in heat processes are important matters in fuel control. W. H. B.

Acetylene generator. O. KAAS. U. S. 1,644,062, Oct. 4.

Colorimeter. W. L. PATTERSON. U. S. 1,643,515, Sept. 27.

Specific-gravity balance. T. F. MANNS. U. S. 1,643,343, Sept. 27.

Apparatus for gravity separation of oil and water or of other liquids of different specific gravities. B. D. COMYN. U. S. 1,645,093, Oct. 11.

Apparatus for determining specific gravity of gases. G. B. LINDERMAN, JR. U. S. 1,644,684, Oct. 11.

Optical pyrometer. G. KEINATH. U. S. 1,644,340, Oct. 4.

Mercury boiler. R. H. COLLINGHAM. U. S. 1,645,092, Oct. 11.

Annealing-furnace. T. STASSINET. *Brit.* 262,803, Dec. 12, 1925. The furnace outlet is heated or heat-insulated to maintain it at a temp. above the condensation point of vapors which may be formed within the furnace.

Filter for solutions for artificial silk manufacture or other liquids. W. H. FURNESS. U. S. 1,643,299, Sept. 27.

Oil filter. C. B. JAHNKE. U. S. 1,644,728, Oct. 11.

Filter for gasoline or other liquids. A. BLACKMAN. *Brit.* 263,017, May 10, 1926.

Float device for decanting and filtering. S. L. GOLDMAN. U. S. 1,644,248, Oct. 4.

System of gas circulation for tunnel kilns. J. KELLEHER. U. S. 1,643,775, Sept. 2.

Jaw crusher for stone and ore. H. J. H. NATHORST. *Swed.* 62,957, May 10, 1927.

Device for introducing or discharging materials to or from reaction vessels operating under high pressures. BADISCHE ANILIN & SODA FABRIK. *Brit.* 262,901, Nov. 5, 1926. A plunger device is provided for ingress and egress of materials from vessels which may operate under 100 atm. pressure or over, e. g., for hydrogenating soft coal or other to produce liquid fuels.

Storage tank for gases and oils or other volatile liquids. J. H. WIGGINS. U. S. 1,643,213, Oct. 11.

Pulp thickener. E. L. OLIVER. U. S. 1,644,854, Oct. 11.

Apparatus for determining turbidity, color or like visual characteristics of fluids. W. G. EXTON. U. S. 1,644,330-1, Oct. 4.

Concentrating apparatus for coal or other minerals. E. DRISTER. U. S. 1,644,112-3, Oct. 1.

Apparatus for sublimation of anthracene, anthraquinone or other substances. F. G. FELD. U. S. 1,644,518, Oct. 4.

Drying apparatus with mechanical transportation of the materials. B. J. F. JONSSON. *Swed.* 61,694, Oct. 12, 1926.

Drying tower. O. NORDSTRÖM. *Swed.* 62,270, Jan. 18, 1927. The materials dried are passed downward between two concentric perforated cylinders. Hot air is introduced into the inner cylinder and by means of a fan are forced through the apertures into the housing surrounding the cylinders from which a part of the gas may be taken out and returned through the fan into the inner cylinder for complete utilization.

Apparatus for drawing off the condensate from cylindric driers. P. O. T. SYLWAN. Swed. 63,122, June 8, 1927. Mech. features.

Centrifuges in which the admixture of air into the separating liquid is prevented. AKTIEBOLAGET SEPARATOR. Swed. 63,049, May 24, 1927.

Centrifuge for the purification of liquids in a closed system for air circulation. AKTIEBOLAGET SEPARATOR. Swed. 63,483, July 19, 1927.

Refrigerating apparatus. PLATEN-MUNTERS REFRIGERATING SYSTEM A.-B. Swed. 62,714, April 5, 1927.

Refrigerating apparatus. AKTIEBOLAGET ARCTIC. Swed. 62,426, Feb. 22, 1927.

Absorption refrigerating apparatus. AKTIEBOLAGET ARCTIC. Swed. 62,933, May 10, 1927. A supplement to Swed. 60,582. A semi-permeable permits passage of the refrigerating medium, for instance NH_3 , in the vapor state but not the liquid.

Absorption refrigerating apparatus. D. W. BERLIN. Swed. 63,609, Aug. 30, 1927.

Cooling chamber with double walls between which the air from the chamber is passed. F. O. LEVANDER. Swed. 61,941, Nov. 16, 1926.

Continuously working apparatus for the analysis of gases. SVENSKA AKTIEBOLAGET MONO. Swed. 61,864, Nov. 2, 1926.

Apparatus for gas analysis, working intermittently, with electric indicating or registering device. SVENSKA AKTIEBOLAGET MONO. Swed. 61,629, Oct. 10, 1926.

Continuously operating gas-analyzing apparatus. OLAF RODHE. U. S. 1,644,951, Oct. 11. An app. is specified which is adapted for detg. CO_2 and other constituents in flue gases, etc.

Apparatus for estimating carbon in iron and steel by measuring its magnetic properties. C. J. G. MALMBERG and J. G. HOLMSTROM. Swed. 63,325, July 12, 1927.

Carbon-monoxide detector. C. S. GORDON and J. T. LOWE. U. S. 1,644,014, Oct. 4. A vessel of easily frangible material such as glass contains salts including Pd chloride, which may be assoc. with NaCl , H_2O and acetone. This vessel is covered with light colored absorbent material and in use the frangible container is crushed and the degree of discoloration indicates the concn. of CO present.

Rectifier or other low-pressure electric discharge tubes. C. G. SMITH. Brit. 263,109, Dec. 21, 1925. A photoionizing filament of W may be placed within a hollow cathode, to facilitate unilateral cond., and reverse currents may be suppressed by a gas such as A having an ionizing potential higher than the normal operating potential of the device. The interior of the cathode may be reflecting and it may be coated with Cs or a Cs alloy or with an alk. earth metal or oxide. Other details and modifications are described. Brit. 263,110-11 also relate to somewhat similar devices. Cf. C. A. 21, 676.

Illuminable thermometer. H. H. ZEAL. U. S. 1,645,211, Oct. 11.

Thermocouple. V. K. ZWORTKIN. U. S. 1,643,734, Sept. 27. Mech. features.

Thermocouple unit adapted for use with recording apparatus, etc. C. A. MARTIN. U. S. 1,643,582, Sept. 27.

Thermostatically controlled valve. W. W. CARSON, JR. U. S. 1,644,325, Oct. 4.

Thermostatic electric switch. R. W. MCBRIEN. U. S. 1,645,201, Oct. 11.

Thermostatic valve. C. R. SHORT. U. S. 1,644,751, Oct. 11.

Thermostatic valve. H. C. MALLORY. U. S. 1,644,786, Oct. 11.

Thermostatically controlled valve. H. R. WHITTIER. U. S. 1,644,501, Oct. 4.

Thermostatic valve control devices. W. B. DALE, R. A. HOPKINSON AND HOPKINSONS, LTD. Brit. 263,058, July 31, 1926.

Thermostat for controlling flow of water in cooling systems, etc. E. J. LEVY. U. S. 1,644,533, Oct. 4.

Thermostatic couple. C. E. FRY. U. S. 1,643,809, Sept. 27. Elements of Ni-Cu and Ni-steel alloys are used together.

Thermostat regulating system for water heaters. H. R. TROTTER. U. S. 1,645,263, Oct. 11.

Thermostatic electric switch. A. J. MOTT LAU. U. S. 1,645,290, Oct. 11.

Thermostatic electric switch. B. H. SMITH. U. S. 1,643,792, Sept. 27.

Electrically operated valve. H. J. SAUVAGE. U. S. 1,643,523, Sept. 27.

Electric remote control for gas valves, etc. H. K. CALDWELL. U. S. 1,644,171, Oct. 4.

Thermostatic control for gas furnaces. H. J. SAUVAGE. U. S. 1,643,858, Sept. 27.

Thermostatic control for furnaces fired with oil or other fluid fuel. H. J. SAUVAGE. U. S. 1,643,859, Sept. 27.

X-ray tube. F. DESSAUER. Brit. 262,906, Nov. 16, 1925.

X-ray tube. G. HOLST. U. S. 2,643,453, Sept. 27.

X-ray tube. JOSEPH SLEPIAN. U. S. 1,645,304, Oct. 11.

2—GENERAL AND PHYSICAL CHEMISTRY

GEORGE L. CLARK

Professor Albrecht Kossel. A. P. MATHEWS. *Science* 66, 293(1927).—An obituary.
E. J. C.

Andrea Naccari. ALESSANDRO AMERIO. *Nuovo cimento* [N. S.] 4, 49-59(1927).—
A brief account of the life and investigations of Andrea Naccari with portrait. L. T. F.

Marcellin Berthelot, and the syntheses of plant life. Y. VOLMAR. *J. pharm.*
d'Alsace Lorraine 54, 213-29(1927).—An address. S. WALDBOTT

The centenary of Berthelot. ANON. *J. pharm. d'Alsace Lorraine* 54, 144-8
(1927).—An account of the celebration of the centenary at the Sorbonne. S. W.

Marcellin Berthelot. GABRIEL HUMBERT. *J. pharm. d'Alsace Lorraine* 54,
111-5(1927).—A review of B.'s work. S. WALDBOTT

Francesco Piola. QUIRINO MAJORANA. *Nuovo cimento* [N. S.] 4, 153-9(1927).—
Obituary notice with portrait. L. T. F.

V. S. Petrov, a Russian physico-chemist of the beginning of the nineteenth century.
B. N. MENSCHUTKIN. *Ann. inst. anal. phys. chim.* 3, 1-13(1926).—Historical. In an
extensive work on the combustion of substances *in vacuo* and inert gases (1801) Petrov
proved that P did not burn (and was not luminous) in the absence of O. In 1803
he described the oxidation of metals between the poles of a voltaic pile (Davy, 1813).
BASIL C. SOVENKOFF

The Nobel prize winners in physics and chemistry in 1925-1926. OLOF SVANBERG.
Industriidningen Norden 55, 377-9(1926).—A brief review of the works of Richard
Zsigmondy, Jean Perrin, The Svedberg, James Franck and Gustav Hertz.

The uniform indexing of papers. J. HANAUER. *Z. angew. Chem.* 40, 1036-7
(1927).
C. A. ROBAK
E. J. C.

Recent advances in science: physics. L. F. BATES. *Science Progress* 22, 197-
201(1927).—A review of recent work on ionization by collisions of the second kind
and on the rate of growth of crystals. JOSEPH S. HEPBURN

The element "mosandrum" of J. Lawrence Smith. R. C. WELLS. *J. Wash.*
Acad. Sci. 17, 385-8(1927).—"When all the facts are considered, it appears that J.
Lawrence Smith should be given credit for recognizing the existence of a new element
in samarskite, although his own preps. were impure and his characterization of the
element was indefinite. The element he named 'mosandrum' was in fact not one
but at least two elements later given the new names samarium and gadolinium."
R. H. LOMBARD

Florentium. LUIGI ROLLA AND LORENZO FERNANDES. *Z. anorg. allgem. Chem.*
163, 40-2(1927).—See C. A. 21, 2404. C. C. DAVIS

Element 61. WALTER NODDACK AND IDA TACKER. *Metallbörse* 16, 985-6; *Chem.*
Zentr. 1926, II, 12.—After a general survey of the history of the discovery of the rare
earths, their place in the periodic table and their properties, the results which have
been accomplished in the search for element 61 are discussed. There is included a
short communication from B. S. Hopkins who had already made known that he had
succeeded in identifying it spectroscopically in Nd-Sa fractions and had named it
dysprosium. According to the research of Hopkins, element 61 occurs in very small
amount in the earths, in conformity with its uneven order no. and its position in the
periodic system. C. C. DAVIS

Review relating to the elements and their structure for the years 1923-1926.
W. HERZ. *Fortschrittsber. Chem. Ztg.* 1927, 69-78. E. J. C.

The derivation of the fundamental relativity-theory laws from de Broglie's hy-
pothesis of phase-waves. ARTHUR HAAS. *Physik. Z.* 28, 632-4(1927). R. J. H.

Molecular transpositions and electronic theories of valence. A. GILLET. *Bull.*
chim. 41, 927-32(1927).—Since 1921 G. has advocated theories of reactions (e. g.,
conjugated bonds, hydrogenation, addition, induced polarity, inequality of C valences,
etc.) formed from conclusions obtained by making a complete list of the data published
concerning a given reaction, submitting them to an objective critical study and formulat-
ing inductive rules. These rules he shows to be in harmony with more recent elec-
tronic interpretations by Prévost, Vavon and Henri. W. T. RICHARDS

A valence-name-formula-solubility chart. G. N. QUAM. *Proc. Iowa Acad. Sci.* **33**, 170(1926).—The chart includes the names and symbols of all the common radicals used in general chemistry courses arranged in a definite order according to valence. Each small rectangular space formed by horizontal and vertical lines including a positive and negative radical represents a compd. and contains a symbol representing the soly. in g. per 100 g. of H_2O at 18° . Each large rectangular space represents compds. having a common type formula. The primary purpose of the chart is to aid the student in acquiring speedily a working knowledge of valence, radicals and formula writing.

W. G. GAESSLER

Valence and addition compounds. JEAN PERRIN. *Compt. rend.* **185**, 557-61 (1927).—P. advances a theory of semi-valence, which reconciles theories of intermediate-compd. formation with the older conception of valence.

C. H. G.

Coördination compounds. N. V. SIDGWICK. *Chemistry and Industry* **46**, 799-807; *Chem. News* **135**, 161-6, 177-83(1927).—The importance of the modern electronic interpretation of the theory of coördination throughout the field of chemistry is emphasized.

RUBY K. WORNER

The methods of study of the relationship between physical magnitudes. B. P. VAINBERG. *Ann. inst. anal. phys. chim.* **3**, 174-80(1926)—A theoretical introduction

BASIL C. SOVENKOFF

Physicochemical studies with tin. IX. The transition temperature of gray tin \rightleftharpoons white tin. ERNST COHEN AND K. D. DEKKER. *Z. physik. Chem.* **127**, 178-82(1927).—The transition temp. of the system gray Sn \rightleftharpoons white Sn has been detd. by the dilatometric method to be between 12° and 14.3° , and is probably very close to 13° .

J. H. PERRY

The polymorphism of zinc. G. I. PETRENKO. *Z. anorg. allgem. Chem.* **162**, 251-2 (1927).—Various investigators have found indications of transformation in Zn at about 175° and 300° . To study these transformations microscopically, 20 to 30 g. Zn is melted and cooled slowly to 380° , 250° and 146° , held at each temp. 20 to 30 min. and then quenched in an ice-NaCl mixt. The sections are etched in dil. $K_2Cr_2O_7$ and HNO_3 . The specimen quenched at 380° showed large polyhedral crystals, with a no. of bright spots probably corresponding to centers of the transformation which takes place at about 300° . Upon the surface of the specimens quenched at 250° and 146° are a great many small polyhedrons. The photomicrographs indicate a transformation point at 300° but none at 175° .

H. STOERTZ

Thermal expansion of silver between -101° and -253° . W. H. KRESOM AND A. F. J. JANSEN. *Verslag Akad. Wetenschappen Amsterdam* **36**, 484-8(1927); cf. C. A. **21**, 2581.—The coeffs. of linear expansion of Ag are for 0° to 100° , 0° to -100° , 0° to -180° , -100° to -180° , -180° to -250° , 19.14, 17.63, 16.89, 15.94 and 10.37×10^{-6} , resp.

G. CALINGAERT

The fusion of carbon. A. THIEL. *Sitz. ges. Beförd. ges. Naturw. Marburg* **1925**, 9 pp.; *Chem. Zentr.* **1926**, 1, 2552-3.—A criticism of works by Lummer (cf. *Verflüssigung der Kohle und Herstellung der Sonnentemperatur*, C. A. **9**, 143), Fajans and Ryschke-witsch (*Z. Elektrochem.* **31**, 54, 63(1925); cf. C. A. **19**, 3505) and Kohn and Guckel (C. A. **19**, 11), with expts. the aim of which was to explain the differences of the m. p. on a basis of capillary elec. phenomena. Conclusion: The m. p. of C in the crater is a function of the d. of the charge at the spot. The scintillations observed by Lummer are attributed to alternate fusion and solidification resulting from local differences in the d. of charge. The local changes in luminosity are caused by the different emission power of the solid and liquid. According to Thiel (*Z. Elektrochem.* **12**, 257(1906)) there is, because of the differing states of charge and surface tensions, a flow of the surface from the areas of lower surface tension to areas of higher surface tension. Moreover the liquid C flows by capillary forces from the locations of highest elec. charge to those of smaller charge. By enlargement of the crater through increase of the current strength, the fusion phenomena which are visible are attracted towards the crater walls. The ideas of T. are only hypothetical, for it is not yet proved that the great temp. differences in detns. of the m. p. of C can be explained by capillary elec. phenomena.

C. C. DAVIS

(Crystal) structure information from 1913 to 1926. P. P. EWALD AND C. HERMANN. *Z. Krist.* **65**, Special supplements, 1-32, 33-48, 49-64(1927).—This represents the beginning of a list of all crystal structure detns. from 1913 to 1926. The order to be followed is (A) elements; (B) compds. of type AB ; (C) type AB_2 ; (D) type A_nB_m ; (E) compds. with more than 2 kinds of atoms, but without a decided complex arrangement; (F) compds. with 2 or 3-atom radicals; (G) 4-atom radicals; (H) 5 or more atom radicals; (L) alloys; (M) mixed crystals. The first installment explains the notation

used, and the sub-division of the groups into various types, while the second and third cover group (A), the elements. The data given include complete references to all investigations, with a brief description of the methods used and the results obtained.

An x-ray investigation of copper, silver and gold. H. JUNG. *Z. Krist.* **64**, 413-29 (1927).—The lattice constns. of Cu, Ag and Au were again checked as 3.62, 4.070 and 4.068 Å. U. These values hold irrespective of the method of prepn. Mixed crystals of Ag-Au occur. Au exists in only one modification, and this is not eutropic with Cu and Ag. Similar relationships hold in other rows of the periodic table, e. g., Co, Rh, Ir; Ni, Pd, Pt; and Cr, Mo, W. Co, Ni and Cr all show a definite contraction in at size as compared with the two remaining elements in each series.

L. S. RAMSDELL

The hexagonal crystal structure of thallium. G. R. LEVI. *Z. Physik* **44**, 603-6 (1927).—In contradiction to Becker's assertion (*C. A.* **21**, 2204) that Tl has a tetragonal structure, the expts. of L., Terpstra, Asahara, Sasahara and Westerlink all agree in assigning to Tl a hexagonal structure.

R. J. HAVIGHURST

The space lattice and lattice constants of artificial and natural nickel and iron alloys. A. O. JUNG. *Z. Krist.* **65**, 309-34 (1927).—The lattice constns. for Ni, Fe and a series of Ni-Fe alloys were detd. by the powder and the Seeman-Bohlin methods. J. finds that the face-centered lattice of Ni persists down to 16-6% of Ni, whereas Andrews (*C. A.* **16**, 1384) found the Fe body-centered lattice for this range. Meteoric tenite, which analyzed Ni 40.8%, Fe 57.8 and P 0.49, is face-centered with $a = 3.601$ Å. U. kamacite (meteoric hexahedrite from Mt. Joy), with 5.32% Ni-Co, has the body-centered Fe lattice with $a = 2.859$, while an artificial alloy with 6.71% Ni-Co has the face-centered Ni lattice, with $a = 3.607$ Å. U. A relatively rapid method for the isolation of tenite is by means of hot 5% H_2SO_4 .

L. S. RAMSDELL

The density, crystal structure and nature of oxygen compounds with oxides of antimony. A. SIMON. *Z. anorg. allgem. Chem.* **165**, 31-40 (1927).— Sb_2O_3 is formed when Sb_2O_4 is heated to 385°, decomposes at 780° to form Sb_2O_4 , which in turn goes over into Sb_2O_5 at 920°. These changes are explained by assuming that an equil. exists between the thermal forces and those tending to maintain the lattice relations of Sb and O atoms. Debye photographs show the 4 oxides have the same lattice structure, the intensity and position of the lines being practically identical. Excepting Sb_2O_4 , which is pseudo-cubical, their crystal structure is cubical. X-ray photographs show Sb_2O_3 to be doubly refractive, while the remaining show no trace of so being. The 5th O atom, in Sb_2O_5 , is so loosely held in the lattice, that the dimensions of the latter are not noticeably influenced by its presence or absence, as shown by its chem. behavior. Density detns. are carried out with a pycnometer and a high-boiling petroleum, as described by Biltz and Wein (*C. A.* **17**, 2376); Biltz and Birk (*C. A.* **18**, 1930). Sb_2O_3 ds. from these and x-ray calcns. are 5.19 and 5.49, resp., the difference being unexplainable. That of Sb_2O_4 increases with the time of heating and at 840° is 5.99 after 1 hr. and up to 7.50 for 150 hrs. Heating Sb_2O_3 at 690°, for 3 hrs. gives a d. of 5.20 and for 6 months, 6.22. Technical Sb_2O_3 , at 840° gives 5.21, while samples contg. 1% of crystn. give values varying from 3.799 for 1 hr.'s heating, up to 5.116 for many hrs. Change of the amorphous to cryst. substance* with increase in time of heating accounts for these variations.

J. BALOZIAN

The structure of zinc hydroxide. C. GOTTFRIED AND H. MARK. *Z. Krist.* **65**, 21 (1927).— $Zn(OH)_2$ is orthorhombic, with a unit cell of the dimensions $a = 6.73$, $b = 5.73$, and $c = 8.47$ Å. U. There are 8 mols. in the cell, which has the symmetry space group V_h^{16} .

L. S. RAMSDELL

The symmetry and the unit cell of stannic iodide. R. G. DICKINSON. *Z. Krist.* **64**, 100-4 (1927).—D. presents evidence to show that the structure proposed by him (*C. A.* **17**, 1740) is correct, rather than those proposed by Ott (*cf. C. A.* **20**, 3108) and Mark and Weissenberg (*C. A.* **17**, 2660).

L. S. RAMSDELL

The crystal lattice of lithium nitride. RUDOLF BRILL. *Z. Krist.* **65**, 94-9 (1927).— Li_3N is cubic, with $a = 5.50$ Å. U. The unit cell contains 4 mols. Two possible structures are given: 4 mols, each with the symmetry C_3 can be placed in space group T_d , or one polymerized mol. Li_3N_4 in group T_1 .

L. S. RAMSDELL

X-ray investigation of the iron carbonyl, $Fe_3(CO)_9$. RUDOLF BRILL. *Z. Krist.* **65**, 85-93 (1927).— $Fe_3(CO)_9$ is hexagonal with a unit cell of the dimensions $a = 6.45$ and $c = 15.8$ Å. U., which contains 4 mols. The space group may be C_{3h}^2 , C_{3h}^4 , C_{6h}^2 , C_{6h}^4 , or D_{6h}^4 . The nine CO groups are at the corners of two octahedrons with a com-

mon face. The Fe atoms are on the trigonal axes perpendicular to this common face.

L. S. RAMSDELL

The crystal structure of Heusler alloys. LEIV HARANG. *Z. Krist.* **65**, 261-85 (1927); cf. *C. A.* **20**, 2266.—In a series of Al-Mn-Cu alloys three cubic lattices were found: face-centered with a varying size; body-centered, composed of Mn and Al, with $a = 2.975$ Å; and a simple cubic lattice of Al and Cu, with $a = 8.71$. The assumption of Heusler that the magnetism is tied up with a compd. $(AlM_3)_x$, where M_3 is an isomorphous mixt. of Cu and Mn is improbable, for the magnetic character cannot be attributed to any single lattice. The structure of Sn-Mn-Cu alloys is partly worked out. A high Sn content gives a hexagonal lattice, apparently due to a Sn-Cu compound, but all films show also many lines which cannot be assigned to any lattice.

L. S. RAMSDELL

The analysis of mixed crystals and alloys. ASLAK ERDAL. *Z. Krist.* **65**, 69-82 (1927).—The system $KBr-NH_4Br$ forms true mixed crystals of the NaCl type for consns. of 0-40% NH_4Br . The results of Vegard are confirmed in that there is no evidence of any regular substitution of NH_4 for the K atoms. The additive law of Vegard holds for these mixed crystals. In the system Ag-Cu true mixed crystals are formed only up to about 6.5% of either component in the other. This figure is obtained from the measured deformation of the lattice by means of the additive law.

L. S. RAMSDELL

A probable relation between twinning and the atomic structure in cubic heteropolar compounds. KARL CHUDOBA. *Z. Krist.* **65**, 133-9 (1927).—No reason for twinning of cubic crystals lies in the crystal lattice. All cubic heteropolar compds. of elements which are near the noble gases in the periodic table, and which have the electronic configuration of these gases, are characterized by lack of twinning. Sylvite is an apparent exception to this rule.

L. S. RAMSDELL

The space group of $(CN_2H_2)_2$ and the crystal structure of $CaCN_2$. U. DEHLINGER. *Z. Krist.* **65**, 286-90 (1927).—Dicyanodiamide is monoclinic (pseudoorthorhombic) with a unit cell belonging to space group C_2^2 , C_2^3 or C_{2h}^2 . The axial ratio is 3.14:1:1.41, and $a = 13.8$, $b = 4.4$ and $c = 6.2$ Å. U. There are 4 mols. in the unit cell. $CaCN_2$ is rhombohedral, with $a = 5.11$ Å. U. and $\alpha = 43^\circ 50'$, or in terms of a hexagonal unit cell, $a = 3.91$ and $c = 14.10$ Å. U. The rhombohedral unit contains 1 mol. with Ca at 000, C at $\frac{1}{3}\frac{1}{3}\frac{1}{3}$ and N at uuu and $-\bar{u}$, $-\bar{u}$, $-\bar{u}$, where $u = 0.37$.

L. S. R.

The symmetry of methane derivatives with four equal groups. K. WEISSENBERG. *Naturwissenschaften* **15**, 662-4 (1927).—X-ray work has shown the pyramidal configuration of constituents around the central atom of pentaerythritol. For amorphous materials evidence for a pyramidal type of C atom in Ca_4 can be derived from the measurement of dipole moments. These moments can be expected in the symmetry groups C_{4v} , C_{2v} and C_4 ; the groups T_d , T , D_{4h} , V_d , S_4 , D_4 , C_{4h} , V_h , V and C_{2h} will be dipole-free. This viewpoint is further discussed qualitatively. Conclusions as to possibilities of stereoisomerism and enantiomorphy due to pyramidal structure are derived.

B. J. C. VAN DER HOEVEN

The space lattice of tetraphenylsilicane. H. MARK AND H. NEHNER. *Z. Krist.* **65**, 455-60 (1927).— $Si(C_6H_5)_4$ is tetragonal, with $a = 11.50$ and $c = 6.97$ Å. U. There are 2 mols. in the unit cell, which belongs to space group V_d^4 or D_{4h}^9 , depending upon the crystal symmetry, which is not fully established.

L. S. R.

Static methods and their application to the study of crystal habits. A. SHUBNIKOV AND O. SHUBNIKOV. *Bull. Akad. St. Petersburg* [6], 1926, 363-84; *Chem. Zentr.* 1926, II, 920.—With wiluite as an example, it is shown that by measuring numerous crystals (335 being measured in the case cited) the most probable surface dimensions and therefore "normal" form of the mineral can be ascertained.

C. C. DAVIS

Investigations of metal crystals. V. Electric and thermal conductivity of single-crystal and polycrystalline metals of the cubic system. E. GRÜNEISEN AND E. GOENS. *Z. Physik* **44**, 615-42 (1927); cf. *C. A.* **20**, 2778.—Elec. and thermal resistance was measured for single-crystal and polycryst. samples of Au, Pt, Cu, W, Rh, Al, Fe, at temps. between -183° and -252° . The thermal resistance of good conductors is detd., as the temp. is lowered, more and more by the degree of purity and of tempering of the metal. An influence of the crystal grain size could not be demonstrated. Thermal resistance may be divided into a "metallic" and a "non-metallic" portion. The metallic portion obeys the Wiedemann-Franz-Lorenz law for cubic metals, independently of the degree of purity or the amount of hardening; the non-metallic portion depends upon the temp., but not upon the degree of purity or of hardening. Samples of one and the same metal, which differ in purity or degree of tempering, have specific thermal

resistance at const. temp. which is a linear function of the sp. elec. resistance.

R. J. HAVIGHURST

A lattice theory calculation of the electrolytic conductivity of the rock-salt crystal. WERNER BRAUNBEK. *Z. Physik* **44**, 684-99 (1927).—From the point of view that the electrolytic cond. of crystals of the NaCl type depends upon the ability of the ions to exchange places in the crystal lattice, a quant. theory of electrolytic cond. is developed. The following simplifying assumptions are made: The vibrations of the ions are linear; energy is statistically divided among individual ions; the Na ions only are in motion. The theory stands in good agreement with exptl. data on the change of cond. with temp. for NaCl.

R. J. HAVIGHURST

The structure of xenotime (YPO₄) and relation between chemical constitution and crystal structure. L. VEGARD. *Phil. Mag.* [7], **4**, 511-25 (1927).—Powder method and rotating crystal diagrams confirm previous results (*C. A.* **11**, 750, 2986) that xenotime and zircon have identical space-lattices. Further general discussion is given regarding chem. constitution and crystal structure.

GEORGE GLOCKLER

A demonstration model for illustrating the Laue effect. G. B. HAGEN. *Physik. Z.* **28**, 453-55 (1927).—A model is described in which the crystallographic planes of a cubic crystal are represented by glass plates arranged, in the proper geometric relations, about rods representing zone axes. When illuminated by a projection lantern, the model gives reflected spots upon a screen, the geometric arrangement of the spots corresponding to that of the Laue diagram.

R. L. HERSHEY

A general property function of aggregates without mixed crystals. JOH. DEJMEK. *Physik. Z.* **28**, 409-17 (1927).—D. presents a new treatment of Lichteneker's logarithmic law of mixts. for calculating the properties of mixtures free from mixed crystals. The elec. resistances of Cd-Sn and Cd-Pb alloys have been calcd. Calcs. for Ag-Bi alloys show a wide discrepancy, which may be due to the formation of solid soln. The logarithmic law requires fulfillment of the law of proportional change of a property of the aggregate; if two properties, a and b , are related by $a = ab^b$ and a is expressed by the logarithmic relation, b is also. The hardness of Zn-Sn alloys was expressed by the logarithmic relation, and qualitative agreement with some old exptl. detns. was obtained.

R. L. HERSHEY

Crystal structure in its relation to chemical problems. R. W. G. WYCKOFF. *Carnegie Inst. Wash. Geophys. Lab. Paper No.* **624**, 20 pp. (1927).—A discussion of crystal structure and its relation to the problems of chemical bondage, secondary valence, atomic radii, the structure of organic compounds, alloys and solid solns., colloids, etc. is given.

R. L. HERSHEY

Structure of silicates. W. L. BRAGG. *Proc. Roy. Inst. Gt. Brit.* (separate), 9 pp.; *ature* **120**, 410-4 (1927); cf. *C. A.* **21**, 1907 (1927).

R. L. HERSHEY

The crystal structure of the trigonally crystallizing heteropolar compounds of the composition MG₃LR₆, MG₃D₂LR₆ and MG₃D₂LR₆. O. HASSEL AND J. R. SALVENSEN. *Z. physik. Chem.* **128**, 345-61 (1927).—Some lines on the rotation diagrams of MgSiF₆·6H₂O and MgTiF₆·6H₂O lead to the conclusion that the true unit cell is a larger rhombohedron than previously reported (cf. Hassel, *C. A.* **21**, 3500). Unit cell dimensions (in A. U.) on this basis, detd. by rotation and spectrographic photographs, are: MgSiF₆·6H₂O, $b = 9.56$, $D = 9.89$; MnSiF₆·6H₂O, $b = 9.66$, $D = 9.75$; FeSiF₆·6H₂O, $b = 9.62$, $D = 9.68$; CoSiF₆·6H₂O, $b = 9.31$, $D = 9.69$; NiSiF₆·6H₂O, $b = 9.26$, $D = 9.50$; ZnSiF₆·6H₂O, $b = 9.32$, $D = 9.64$; MgTiF₆·6H₂O, $b = 9.77$, $D = 9.85$; ZnTiF₆·6H₂O, $b = 9.55$, $D = 9.88$; ZnZrF₆·6H₂O, $b = 9.77$, $D = 10.11$; MnZrF₆·6H₂O, $b = 9.77$, $D = 10.02$; ZnSnF₆·6H₂O, $b = 9.71$, $D = 10.19$; Co(NH₃)₆·4Co(CN)₆, $b = 10.89$, $D = 10.81$; Co(NH₃)₆Cr(CN)₆, $b = 11.15$, $D = 10.90$; Co(NH₃)₆·4Co(CN)₆, $b = 10.74$, $D = 10.85$; Co(NH₃)₆H₂O·Fe(CN)₆, $b = 10.74$, $D = 10.84$; Co(NH₃)₆(H₂O)₂Co(CN)₆, $b = 10.62$, $D = 11.01$. b is one-half the face diagonal of the rhombohedral unit cell and D is the space diagonal. The rhombohedral angles in all cases are between 112° and 113°.

R. L. HERSHEY

The crystal structure of potassium dihydrogen phosphate. S. B. HENDRICKS. *Am. J. Sci.* **14**, 269-87 (1927).—Laue, rotation and powder photographs were taken. The lattice is body-centered tetragonal; $d_{(001)} = 6.97$ A. U.; $d_{(100)} = 7.42$ A. U. There are 4 mols to the unit cell. Intensity analysis gives the space group as 4d-12, with P atoms at (a), K at (b) and O at (c). Calcs. to det. the true time of exposure of the different parts of a plate 10 cm. from the crystal, perpendicular to the incident beam and parallel to the axis of rotation are made and a chart of the results is given.

R. L. HERSHEY

The crystal structure of mercuric oxide. WILLIAM ZACHARIASEN. *Z. physik. Chem.* **128**, 421-9 (1927).—HgO was examd. by the powder method. It is found to

be rhombic, with 2 mols. to the unit cell; $a = 3.296$ A. U.; $b = 3.513$ A. U.; $c = 5.504$ A. U.; d. calcd. is 11.22. The Hg atoms form a body-centered lattice; several possibilities are discussed for the O atoms. The conclusion of G. R. Levi that red and yellow PbO are crystallographically identical is verified.

R. L. HERSHEY

The crystal structure of magnesium telluride. WILLIAM ZACHARIASEN. *Z. physik. Chem.* **128**, 417-20 (1927).—MgTe was prepd. directly from the elements in an atm. of H_2 . Powder pictures show MgTe to be of the wurtzite type: $a = 4.52 \pm 0.02$ A. U., $c = 8.33 \pm 0.04$ A. U. An assumption of 2 mols. per unit cell gives a d. of 3.86; u is about $\frac{1}{8}$; the Mg-Te distance is 2.76 A. U. Mg atoms are at $(\frac{1}{2}, \frac{1}{2}, 0)$, $(\frac{1}{2}, \frac{1}{2}, \frac{1}{2})$; Te atoms are at $(\frac{1}{2}, \frac{1}{2}, u)$, $(\frac{1}{2}, \frac{1}{2}, u + \frac{1}{2})$.

R. L. HERSHEY

The crystal structure of palladium oxide. WILLIAM ZACHARIASEN. *Z. physik. Chem.* **128**, 412-6 (1927).—Powder pictures have been taken of a mixt. of PdO and Pd. PdO is tetragonal; $a = 3.209 \pm 0.005$ A. U.; $c = 5.314 \pm 0.005$ A. U. There are 2 mols. per unit cell; d. calcd. is 8.31. The metal atoms form a body-centered lattice; the positions of the O atoms are not definitely detd. PdO is probably isomorphous with SnO and red PbO.

R. L. HERSHEY

The cleavage of rock-salt crystals in rhombic dodecahedral and octahedral surfaces. V. D. KUZNETZOV. *Z. Physik* **42**, 905-9 (1927).—To cleave rock-salt crystals in the (110) surfaces requires 1.76 times as much energy as a step-wise cleavage, in which the planes of the steps are parallel to the cube sides; hence the actual cleavage in (100) planes always occurs in the step-wise manner. The energy required for experimental cleavage is thus somewhat less than the theoretical: $\sigma_{(110)} = 2.50\sigma_{(100)}$, theoretically, $\sigma'_{(110)} = \sqrt{2}\sigma_{(100)}$ practically. $\sigma_{(hkl)}$ is the surface energy of the face (hkl). Similarly for cleavage on the (111) planes, 3.36 times as much energy is necessary for the cleavage on (111), as for a cleavage surface consisting of small triangular pyramidal elevations and depressions, the pyramid sides being parallel to the cube faces. The actual experimental value is $\sigma'_{(111)} = \sqrt{3}\sigma_{(100)}$ instead of $\sigma_{(111)} = 5.81\sigma_{(100)}$ which theory predicts.

R. L. HERSHEY

Note on investigations into the strength of rock salt, quartz and fluorspar. W. EWALD. *Glasindustrie* **34**, 7 (1926); cf. *C. A.* **20**, 3253.—The transverse strength of a square prism of rock salt, quartz and fluorspar, cut parallel to a crystal face, when bent across one edge of the prism was approx. 1.25 times as great as when bent across one face. The ultimate tensile strength of rock salt was 570 g. per sq. mm. and the transverse strength 1190 g., confirming the values obtained by Voigt.

H. F. K.

Study of muscovite mica by means of X-rays. CHARLES MAUGUIN. *Compt. rend.* **185**, 288-91 (1927).—Rotation diagrams show the lattice to be monoclinic; the unit cell edges are: $a = 5.17$ A. U.; $b = 8.94$ A. U.; $c = 20.0$ A. U.; the plane of cleavage is parallel to the plane ab ; the angle ac is 96° . There is no pure symmetry plane, but a glide plane of symmetry; there are 2 mols. per unit cell. The relations between the crystal structure and other observed properties are discussed.

R. L. HERSHEY

The crystal structures of mercuric and mercurous iodides. M. L. HUGGINS and P. L. MAGILL. *J. Am. Chem. Soc.* **49**, 2357-67 (1927).—The crystal structures of tetragonal HgI_2 and Hg_2I_2 have been detd. with the aid of data from special photographs and Laue photographs. Results are in agreement with those of Bijvoet, Claassen and Karssen (*C. A.* **20**, 2264), Havighurst (*C. A.* **20**, 526, 2925) and Hylleraas (*C. A.* **20**, 852).

R. J. H.

Single iron crystals. III. The magnetization in various crystal directions. R. DUSSLER and W. GERLACH. *Z. Physik* **44**, 279-85 (1927); cf. *C. A.* **21**, 2591. The rectilinear ascent of the magnetization curve, the sharp break, and the vanishing remanence, previously observed as characteristic of Fe crystals, are confirmed. The initial permeability in the tetragonal direction is greater than in the digonal. Satn. in the tetragonal direction occurs earlier than in the digonal but both have approx. the same magnitude. The break in the magnetization curve for the tetragonal direction occurs at higher magnetization but at approx. the same field strength as for the digonal. The results of Honda and Kaya, though less positive, are interpreted as confirming these conclusions, the discrepancies being explained as due to mechanical destruction of the Fe crystals in the specimens used by H. and K. New results obtained by extending the measurements to high and low temps. are: the initial magnetization is independent of the temp. within a few %; the breaks in the magnetization curve become sharper with increasing temps. but occur at lower intensities of magnetization; satn. decreases with increasing temp. and is reached at lower fields, e. g., for the tetragonal direction at 20° , satn. is reached at approx. 150 gauss; at 629° , at 4.5 gauss; at 680° at 3.5 gauss; and for 739° , at 2.5 gauss.

W. W. STIFLER

Historical review of the subject of recrystallization. J. CZOCHRALESKI. *Z. Metallkunde* 19, 316-20(1927).—The work done on this subject down to the end of the year 1921 is discussed and tabulated.

H. STOERTZ

X-ray analysis of chromium-carbon systems. ARNE WESTGREN AND GÖSTA PHRAGMÉN. *Kgl. Svenska Vetenskapsakad. Handl.* 2, No. 5, 11 pp.(1926); *Mineralog. Abstracts* 3, 336.—Three Cr-C compds. are indicated by x-ray data: cubic with $a = 10.638$ Å. U. and 24 Cr₄C mols. in the unit face-centered cube; hexagonal with $a = 13.98$, $c = 4.523$ Å. U. and $c/a = 0.324$ with 8 mols. of Cr₇C₃ in the structure, and orthorhombic with $a = 2.821$, $b = 5.52$, $c = 11.46$ Å. U. corresponding to $a:b:c = 0.246:0.480:1$ with 4 mols. of Cr₃C₂ in the unit cell.

J. F. SCHAIERER

Theory of gases and equation of state. II. J. DUCLAUX. *J. phys. radium* 8, 336-43(1927).—It is sought to establish a theory of gases on the following hypothesis: there is no action at a distance between the mols. of gases. Either the mols. are completely independent or they are chemically combined. The combinations follow the general laws of chem. mechanics. As it has previously been shown, this hypothesis leads, for the compressibility and expansion of gases, to results in complete accord with expt. It represents with the same success the variations of the specific heat, either with pressure, or with temp. It is successful with viscosities.

L. D. R.

Pressure, volume and temperature chart. ANON. *Power* 66, 544-5(1927).—A Cartesian nomogram illustrates the approx. interrelation of temp. in degrees F., pressure in lbs. per sq. in. and vol. of an ideal gas.

D. B. DILL

Hydrodynamics and the kinetic theory of gases. YVES ROCARD. *Ann. phys.* 8, 5-120(1927).—Mathematical and a review.

J. H. PERRY

Tables for the reduction of gas volumes to 0°, 760 mm. mercury. N. LEROY AND L. PLANTÉFOL. *Ann. physiol. physicochim. biol.* 3, 377-80(1927).—Tables are given for the correction of barometric pressure to a temp. of 0°, and for a reduction of vol. of gas satd. with H₂O vapor to 760 mm. and 0°.

H. J. DEUEL, JR.

The influence of diffusion of oxygen on the rate of combustion of solid carbon. I. T. WARD AND J. B. HAMBLÉN. *Ind. Eng. Chem.* 19, 1025-7(1927).—Previous expts. which led to the hypothesis that the rate of combustion of solid C must be detd. by the rate at which O can diffuse through the film to the surface of the C are reviewed and theoretical considerations are discussed. An illustrated description is given of the app. designed to obtain direct exptl. data on this problem. A capillary quartz tube was sealed to a block of C placed in a furnace. The gas evolved upon heating the C was carefully collected and analyzed in a special directly connected precision gas analysis app. The data obtained in 6 runs and computations of these gas analyses on the basis of 100 mols. of N and O-N ratio are tabulated. Conclusion: When solid C burns, the controlling variable is not the rate of chem. interaction of C and O, but is the rate of diffusion of the combustion gas through the gas film.

W. W. HODGE

Dissociation of carbon dioxide at high temperatures. W. T. DAVID. *Nature* 120, 15-19(1927).—D. believes that Fenning and Tizard's (*C. A.* 21, 3300) assumption of chem. equil. at the time of max. pressure in CO + O₂ explosions is erroneous and that therefore their results on CO₂ dissocn. are much too high. Unpublished expts. by R. A. Smith between 1600° and 3000° with CO + varying amts. of air showed that the amt. of uncombined gas at max. pressure in completely combustible mixts. is at least 10% of the original charge below 2000° and increases with temp. It is assumed that below 2000° this is due to incomplete combustion and that above 2000° an additional CO₂ dissocn. effect sets in. The expts. were performed in a spherical 6-in. vessel, the gas mixt. being at atm. temp. and pressure.

B. J. C. VAN DER HORVEN

The theory of streaming of an elastic liquid in a Couette apparatus. MARKUS REICLER AND RASSA RIWLIN. *Kolloid Z.* 43, 1-5(1927).—An elastic liquid and a plastic material only differ in that the former on slight pressure acts like an elastic solid while the latter at high pressure flows as a true liquid. On this basis a formula has been derived which can apply to the Couette app. The criterion for elasticity of a liquid is given by the velocity of rotation of the outside cylinder of the app. necessary to cause all the material to adhere to it.

R. H. LAMBERT

A general relation between an adiabatic coefficient of elasticity and the absolute melting temperatures for several metals. L. P. SIEG. *Phys. Rev.* 25, 251-2(1925).—A relationship is derived connecting Young's modulus with the ordinary isothermal modulus. The former as calcd. from published data for Al, W, Cu, Fe, Ag and Pt remains const. till about 1/3 of the abs. m. p. is reached when a sudden increase occurs.

F. O. A.

Preparation of electrolytically pure water. E. F. KRAUZE AND A. V. NOVOSELOV. *Russ. Phys.-Chem. Soc.* 58, 1222-9(1926).—The following app. was used: a spiral

condenser of pure tin, a U-tube with 2 Pt electrodes for checking the cond. of small amts. of distd. water, storage bottles for electrolytic water. The outside air (pure air) was connected with the usual absorbers for CO_2 , etc. All rubber connections were boiled in water before the expt. Storage bottles (of opaque glass) were steamed out for 5-6 days. The Pt electrodes used for measuring the resistance were of a modified E. Pfeifer type (*Ann. Chem. Phys.* 25, 232(1885)). The still was of sheet copper (60 l. capacity) with a cover of pure tin. 50-55 l. of freshly distd. water was used. The receiver was connected with the fresh-air line (distn. started in $1\frac{1}{2}$ hrs.). After the distn. the water was kept at 25° in a thermostat and air free from CO_2 blown through for 2 days, when const. cond. was reached. Sp. cond. before air treatment was 0.7 to 0.9×10^{-6} and 0.2 to 0.3×10^{-6} after.

A. A. BOEHTLINGK

The molecular pressure of associated liquids. K. STAKHORSKII. *Ukrainskii Khim. Zhurnal* 1, 544-52(1925); *Chem. Zentr.* 1926, II, 157.—The internal pressure B of liquids is calcd. from the equation: $B = 427.8 T_a/(xV)$, where T_a is the b. p., x the degree of assocn., V the mol. vol. in cc., B being expressed in atm., and values of x already found (*C. A.* 20, 2769) being utilized. B is equal to 77.75γ , where γ is the surface tension (cf. Walden, *C. A.* 3, 2077). For the capillarity const. a^2 , there is derived an equation: $xM^2/T_a\zeta = \text{const.}$, which is similar to the Walden equation (cf. *C. A.* 3, 266), and in which M is the mol. wt., T_a the m. p., and ζ the diam. of the mol. or the atom.

C. C. DAVIS

Attempt at a comparative study of vapor pressure curves. I. BERKMAN. *Ukrainskii Khim. Zhurnal* 1, 553-78(1925); *Chem. Zentr.* 1926, II, 170.—If T_a is the b. p. of a liquid at the pressure p , and T_b is the b. p. of another liquid at the same pressure, then according to Ramsay and Young: $T_a = cT_b^2 + dT_b$, where c and d are consts. which are independent of the pressure and temp. When $T_a = (1 - d)/c$, $T_a = T_b$, i. e., the temp. curves intersect, and therefore the consts. c and d can be calcd. from this intersection. For homologous compds. c has practically the same value (0.0001 for esters of fatty acids, 0.0006 for phenyl halides, etc.), while d increases uniformly with increase of mol. wt. if water is chosen as the liquid of reference. Only alics. have negative c values (based on water); the c values are positive and highest in the paraffin series, decreasing from the hydrocarbons to the esters to the acids, decreasing therefore from the normal type of compd. to that with associating groups.

C. C. D.

The physical properties of some cyclohexane derivatives. N. N. NAGORNOV AND L. A. ROTINYANTZ. *Ann. inst. anal. phys. chim.* 3, 162-73(1926).—The crit. temp. of $\text{C}_6\text{H}_{11}\text{Me}$ is 301.5° ; b_{760} 100.8° ; $dp/dt = 21.1$ mm. at b. p.; $d_{-78.4}$ 0.8540 , d_0 0.7865 , $d_{19.8}$ 0.7696 and $d_{100.6}$ 0.6971 . $\text{C}_6\text{H}_{11}\text{Cl}$ m. -43.9° , b_{760} 142.9° , $dp/dt = 19.9$ mm. at b. p.; crit. temp. is 314.25° , probably due to decompn. at high temps., d_0 1.0180 , $d_{19.2}$ 0.9994 , $d_{100.1}$ 0.9193 . $\text{C}_6\text{H}_{11}\text{OH}$ b_{760} 160.6° ; $dp/dt = 22.5$ mm. at b. p.; crit. temp. 377° ; d_{25} 0.9440 , $d_{138.6}$ 0.8235 . Ratios of the abs. temps. and vols. at equal pressures are nearly const. except for $\text{C}_6\text{H}_{11}\text{OH}$, which belongs to assocd. liquids. Albertosi's relationship does not accord with the thermal expansion of $\text{C}_6\text{H}_{11}\text{Me}$ at low temps.; the law of Cailletet and Mathias, on the other hand, holds well at temps. corresponding to the vapor pressures below 100 mm. Mol. vols. of C_6H_{12} derivs. exceed those of C_6H_6 and derivs. by 21. The compds. studied are normal in the vapor state.

BASIL C. SOYENKOFF

A critical analysis of equations for the design of fractionating columns. L. H. SHIRK AND R. E. MONTONNA. *Ind. Eng. Chem.* 19, 907-11(1927).—An $\text{EtOH-H}_2\text{O}$ mixt. was distd. in a lab. column and the data obtained were calcd. by the methods of (A) McCabe and Thiele (*C. A.* 19, 1970), (B) Rodebush (*C. A.* 16, 4288), (C) Murphree (*C. A.* 19, 3040), (D) Lewis (*C. A.* 16, 2561), (E) Peters (*C. A.* 18, 136), and (F) Leslie ("Motor Fuels," *C. A.* 17, 1543). Method (A) was the most practical. Method (B) was more accurate for a small no. of plates but more difficult to use. Method (C) gave results identical with (A) but required much longer calcs. Method (D) was in error for a small no. of plates, and has no advantage over (A). Method (E) contains errors, and when these are corrected the results check (D) for a rectifying column but give absurd results for an exhausting column. Method (F) is very long, but gives results more like (A) and (B) than the other mathematical methods.

W. L. BADGER

Structure in surfaces of liquids. J. W. MCBAIN. *Nature* 120, 362(1927).—A reply to the criticism of Hatschek on the general hypothesis of rigidity in colloidal solns. absent in true liquids. McB. believes the more general view preferable whatever the form of ramifying aggregates is present.

R. H. LAMBERT

The viscosity of liquids above their boiling points. IV. TOSHIZO TITANI. *Bull.*

J. Chem. Soc. Japan **2**, 225-9(1927); cf. *C. A.* **21**, 3506.—In part II of the paper (cf. *A. 21*, 3291) the following equations were obtained, expressing the relations between the mol. fluidity ϕ defined as the reciprocal of $\eta \cdot V^{1/3}$ and mol. vol. V or temp. T : $\phi = K(V^{2/3} - B^{2/3}) \dots (I)$ and $\phi_K - \phi = C(T_K - T)^{1/3} \dots (II)$, where K and C are arbitrary consts., and ϕ_K , T_K , crit. consts. B , an effective mol. vol. in equation (I), is of additive nature. It can be computed by assuming $C = 6.9$, $H = 5.1$, $O = 7.5$, $Cl = 20.0$, $F = 10.5$, double linking = 3.0, iso-grouping = 0. The resp. const. in the vol. and temp. relations becomes independent of the nature of the substance when it is expressed in reduced form. From the vol. and temp. relations of the mol. fluidity, the reduced equations of the following form have been obtained: $\phi_r = k_r(v_r^{2/3} - b_r^{2/3})$; $1 - \phi_r = c_r(1 - t_r)^{1/3}$; $\phi'_r = k'_r(v_r^{2/3} - b_r^{2/3})$; $\phi'_{Kr} - \phi'_r = c'_r(1 - t_r)^{1/3}$. A. L. HENNE

The molecular constitution of liquids. VL. KISTYAKOVSKII. *J. chim. phys.* **24**, 200-21(1927).—Depending on assocn. and cond. liquids may be grouped as follows: (1) the least polymerized liquids, as the satd. hydrocarbons from pentane to decane and the rare gases, except He; (2) slightly polymerized, as the cyclic hydrocarbons and halogen derivs.; (3) those appreciably polymerized, as the halogen acids and most of the elements; (4) highly polymerized, including H_2O , the alcs. and amines; (5) those polymerized in both liquid and gaseous states, as S, As, Se, P, etc.; (6) ionized liquids, as the fused salts; (7) electronic liquids, consisting of the fused metals. Variations from the Guldberg-Guye relationship ($T_K/T_B = 1.5$) cannot be used to classify liquids. Nor does a study of the heat of vaporization assist in grouping. Certain equations for mol. vol., temp. and d. aid in distinguishing liquids of groups 1, 2 and 3. Liquids of groups 1-5 can be distinguished from v. p. relationships. E. G. VANDENBOSCHÉ

The molecular association in liquid state. K. M. STAKHORSKII. *J. chim. phys.* **24**, 204-8(1927).—For the same liquid mixts. the degree of assocn., that is the factor to replace the mixts. of the various mols with a compd. mol. of the same mol. wt., decreases with increasing temp. J. A. SZILARD

Solubility and surface tension. I. TRAUBE, ILSE SCHÖNING and L. J. WEBER. *Ber.* **60B**, 1808-11(1927).—The solubilities of 25 Na salts of org. acids in org. solvents as well as the solubilities of aniline-HCl in isoamyl alc. and in paraldehyde have been studied at 18°. In general, the greater the soly. increase, the greater is the lowering of the surface tension of the H_2O by the salt concerned. Exceptions to this are the cases of Na benzoate and Na salicylate. The soly. of Na benzoate in alcs. increases in the series: octyl, amyl, butyl alcs. J. H. PERRY

Vapor pressures of diphenyl and of aniline. F. J. GARRICK. *Trans. Faraday Soc.* **23**, 560-3(1927).—In the course of comparing the vapor pressures of high-boiling org. substances with that of Hg by means of the Ramsay-Young rule, an anomaly was observed with diphenyl, the data of Jacqueroed and Wassmer (*Ber.* **37**, 2533(1904)) being used. The curve obtained by plotting T_1/T_2 against T_1 (where T_1 and T_2 are the abs. temps. at which diphenyl and Hg, resp., have the same vapor pressure) showed a sharp change of slope at about 224°, the 2 arms being nearly straight lines. As the ratio T_1/T_2 only changes by about 2% for 100°, the graph can be made on a very large scale and is therefore very sensitive to small inaccuracies. A break such as is observed would therefore correspond to a discontinuity in the actual vapor pressure too small to be noticed on smoothing. Consequently the vapor pressures of diphenyl and of aniline have been redetd. and tabulated. The graphs obtained show no anomalies. In the following data, the temps. in °C. and the vapor pressure in mm. are given, resp. *Diphenyl*: 150.00, 33.02; 155.00, 40.73; 160.00, 49.65; 165.00, 59.88; 170.00, 71.75; 175.00, 85.49; 180.00, 101.13; 182.00, 107.89; 184.00, 115.01; 186.00, 122.54; 188.00, 130.39; 190.00, 138.58; 192.00, 147.40; 194.00, 156.62; 196.00, 166.07; 198.00, 176.19; 200.00, 186.75; 202.00, 197.93; 204.00, 209.62; 206.00, 221.74; 208.00, 234.58; 210.00, 248.00; 212.00, 261.95; 214.00, 276.78; 216.00, 292.13; 218.00, 308.38; 220.00, 325.24; 222.00, 343.11; 224.00, 361.56; 226.00, 380.92; 228.00, 400.92; 230.00, 421.77; 232.00, 443.15; 234.00, 466.24; 236.00, 490.26; 238.00, 514.90; 240.00, 540.68; 242.00, 567.62; 244.00, 595.76; 246.00, 624.99; 248.00, 655.25; 250.00, 686.53; 252.00, 719.25; 254.00, 753.81. *Aniline*: 96.00, 37.43; 98.00, 40.69; 100.00, 44.53; 102.00, 48.39; 104.00, 52.00; 106.00, 57.25; 108.00, 62.18; 110.00, 67.46; 112.00, 73.09; 114.00, 79.13; 116.00, 85.88; 118.00, 92.47; 120.00, 99.80; 122.00, 107.68; 124.00, 115.99; 126.00, 124.88; 128.00, 134.36; 130.00, 144.42; 132.00, 155.12; 134.00, 166.41; 136.00, 178.46; 138.00, 191.15; 140.00, 204.95; 142.00, 219.15; 144.00, 234.53; 146.00, 250.58; 148.00, 267.64; 150.00, 285.81.

A. L. HENNE

A relation between orthobaric densities. II. JURÔ HORIUCHI. *Bull. Chem.*

Soc. Japan **2**, 213-24(1927).—H. proves the validity of the equation $\psi = RT \ln V_0/V_i = A\{[1/(V_i - E)] - [1/(V_0 - E)]\}$ (cf. *C. A.* **21**, 680), by making the actual calcs. for many substances, at various temps. The substances investigated were: CO_2 , N_2O , NH_3 , SO_2 , COCl_2 , C_3H_{12} , C_6H_{14} , diisopropyl, diisobutyl, C_7H_{16} , fluoro-, bromo-, iodobenzene, CHCl_3 , CCl_4 , CS_2 , HCOOMe , EtCOOMe , Me isobutyrate , AcOEt , EtCOOEt , AcOPr , MeCOMe . They all agree well with the equation except at temps. immediately near the critical temp. The consts. E have been tabulated for 42 substances; it is shown that their value may be computed satisfactorily by means of the following additive consts.: $\text{H} = -0.54$, $\text{C} = 12.1$, $\text{O} = 4.0$, $\text{F} = 4.35$, $\text{Cl} = 2\text{F} = 8.70$, $\text{Br} = 3\text{F} = 13.05$, $\text{I} = 4\text{F} = 17.4$, double bond = -1.6 , $\text{OH group} = 16.2$, ring formation = -13.7 .

A. L. HENNE

Volume studies in homologous series. F. WRATSCHKO. *Pharm. Presse* **32**, 251-5, 268-74(1927), cf. *C. A.* **21**, 2826.—Numerous equations are developed and discussed bearing on the relationship between the density and constitution of oxygenated hydrocarbons. The calcd. results are given in great detail and tabulated form.

W. O. E.

Fluctuations of dielectric constant in liquids and theories of molecular scattering of light. K. R. RAMANATHAN. *Indian J. Physics* **1**, 413-36(1927); cf. *C. A.* **21**, 2847.—The question of fluctuations of dielec. const. of a small vol. element of a liquid is discussed with reference to the theories of mol. scattering of light. Reasons are given for concluding that the fluctuations of dielec. const. responsible for scattering cannot be detd. by differentiating Lorentz's relation between dielec. const. and d but that the factor $(K + 2)/3$ must be omitted from the expression δK . Revised expressions for the intensity and polarization of the scattered light are given in terms of the mol. theory. Gans's phenomenological method of treatment is outlined and discussed and the assumptions underlying it are pointed out. If the omission of the $(K + 2)/3$ factor of the expression for δK be accepted, Gans's theory and mol. theory lead to identical results. It is shown that if the mols. of a liquid are anisotropic, small vol. elements must necessarily possess accidental deviations from isotropy; the relation between them, the consts. of mol. anisotropy and the Kerr const. of double refraction are worked out. Similar arguments should hold in the case of binary liquid mixts. and the fluctuations of concn. accidentally occurring in such a mixt. cannot be assumed to be identical with the changes of dielec. const. with concn. obtained from expts. on liquids in mass. Revised expressions for scattering are given.

M. F.

Dielectric constants of gaseous ethyl ether and ethyl alcohol. R. SÄNGER. *Physik. Z.* **28**, 455-57(1927).—The dielec. consts. of Et_2O and EtOH for a const. d and with varying temp. have been measured. Plots of $(E - 1) \cdot 10^5$ vs. $10^3/T$ show agreement with the simplified Debye equation $(E - 1) = A + B \cdot (1/T)$ over the whole temp. range for Et_2O , deviations occurring at temps. below 393°K . for EtOH . These deviations, in which $(E - 1)$ rises above the linear values, are attributed to associative effects. These effects depend upon the relative sizes of the elec. moment and the mol. The elec. moment in comparison with the mol. size is much less for the ether than for the alc.; hence deviations appear only in the latter. Considerations of the const. A show that measurements of the dielec. consts. of dil. solns., if only the dependence of the const. on concn. is known, are inadmissible as a basis for calcg. the elec. moment.

R. L. HERSHEY

Dielectric constants of dilute aqueous electrolytic solutions. R. SKANCKE AND E. SCHREINER. *Physik. Z.* **28**, 597-604(1927).—The theory of the Wheatstone bridge method with high-frequency current for the detn. of the dielectric consts. of dil. electrolytic solns. is given. The app. used is described in detail. Exptl. results obtained with dil. solns. of LiCl , KCl , BaCl_2 , $\text{La}(\text{NO}_3)_3$, MgSO_4 and $\text{K}_4\text{Fe}(\text{CN})_6$ are given in the form of curves of the dielec. consts. plotted against the concns.

E. R. SMITH

The dependence of the dielectric constants of certain gases upon temperature. HANS-JOACHIM V. BRAUNMÜHL. *Physik. Z.* **28**, 141-9(1927).—Gases are divided into 2 classes on the basis of the dependence of their dielec. consts. on temp. The one kind shows a change in the const. which is attributable entirely to the d . change due to thermal expansion; the other shows additional changes. The behavior of gases of the second kind is given by the Debye expression $(1/4\pi)(m/\rho)(E - 1) T = aT + b$, where m is the mass of the mol., ρ the d , T the abs. temp. and a and b are consts. Measurements have been made on H_2 , A , CO , CO_2 , N_2O , H_2S and HCl over a temp. range of from 290°K . to 400°K . The results verify the linear character of the Debye function. H_2 and A are gases of the first kind, b , the dipole component, being zero. Values of a and μ , the elec. moment, calcd. from $b = (1/3)(\mu^2/k)$, where k is the Boltzmann const., are: A , $a = 1.68 \times 10^{-24}$, $\mu = 0$; CO , $a = 1.96 \times 10^{-24}$, $\mu = 0.124 \times 10^{-18}$.

CO_2 , $a = 2.09 \times 10^{-24}$, $\mu = 0.145 \times 10^{-18}$; N_2O , $a = 2.83 \times 10^{-24}$, $\mu = 0.249 \times 10^{-18}$; H_2S , $a = 0.69 \times 10^{-24}$, $\mu = 1.101 \times 10^{-18}$; HCl , $a = 1.40 \times 10^{-24}$, $\mu = 1.180 \times 10^{-18}$.

R. L. HERSHEY

The dielectric constants of binary mixtures. III. The electric moments of certain organic molecules in carbon tetrachloride solution. I. J. KRCHMA AND J. W. WILLIAMS. *J. Am. Chem. Soc.* **49**, 2408-10(1927); cf. *C. A.* **21**, 3151.—The results obtained from the dielec. const. and density data with CCl_4 as a non-polar solvent for certain org. mols. are in all respects similar to those obtained where benzene was used as the solvent. With benzene and toluene as solutes the molar polarization is const. throughout the whole range of concn. With the other solutes, CHCl_3 , Et_2O , AcOMe , AcOEt , acetone, EtOH and isoamyl alc., the calcd. molar polarization varies with the concn. The elec. moments of each of the solute mols. in CCl_4 have been calcd., the Langevin-Debye modification of the Clausius-Mossotti law being used.

IV. Benzene as a solvent for certain solid substances. J. W. WILLIAMS AND R. J. ALLGEIER. *Ibid* 2416 22.—The solutes are benzoic acid, phenol, I , SbI_3 , SnI_4 and AgClO_4 . Although the limited soly. of the solutes limited the measurements to a small range of concn., it was possible, except in the case of SbI_3 , to det. by extrapolation the molar polarization of the solutes. For each of the 5 solutes this molar polarization is const. over the range of its soly. The elec. moments of each of the solutes has been calcd. as in the paper abstracted above.

JAMES M. BELL

The chemistry of solid substances. Polymorphic transitions in mercuric iodide and sulfur. H. W. KOHLSCÜTTER. *Kolloidchem. Beihefte* **24**, 319-64(1927).—The transitions of polymorphic solids are considered as ideal cases of topochem. reactions. Macroscopic and microscopic observations were made on single crystals of yellow HgI_2 . The latter were prepd. from red HgI_2 by sublimation at low pressure or in a stream of indifferent gas. At room temp. the yellow modification slowly changes from lemon-yellow to bright yellow and then to red. The change is more rapid for large crystals than for small ones. The transition HgI_2 (red) \rightarrow HgI_2 (yellow) is sharp at 129-130°. Previous detns. of the transition temp. (127°) were made with finely divided material. The transition from yellow to red is more rapid in an atm. of H_2 than in O_2 . A white modification (Tamman, *C. A.* **14**, 2450) was confirmed but could not be established as a definite allotropic form. A tetragonal orange modification was prepd. by gradually cooling the vapor. This modification is very stable. The S_{III} modification of S (Muthmann, *Z. Krist.* **17**, 336) was prepd. and its transition to rhombic S observed.

J. E. SNYDER

The equation of state of solids. IV. Heats and pressures of vaporization, sublimation and fusion down to zero temperature; their relation to Nernst's theorem. J. VAN LAAR. *Verslag Akad. Wetenschappen. Amsterdam* **36**, 311-28(1927); cf. *Ibid* **35**, 159, 403(1926).—A continuation of previous papers. Equations are developed for the three equilibria $\text{V}-\text{I}$, $\text{V}-\text{S}$ and $\text{L}-\text{S}$ for $\log p$ as a function of temp., heat of transformation and the van der Waals constants "a" and "b." Separate solns. are given for higher and for low temps. The improper use of extrapolation (including chemical constants," $1.75 \log T$ term, etc.) as practiced in many applications of Nernst's theorem is particularly criticized. Only solid phases show degeneration (Debye T^3 term in internal energy) at low temps., no degeneration or quantum effect ever occurs for liquids and gases.

B. J. G. VAN DER HOEVEN

Information on physico-chemical properties of mercurisulfosalicylates. I. SOPHIE BERGMAN AND H. ZOCHER. *Kolloid Z.* **42, 309-22(1927); cf. *C. A.* **20**, 3611.—The swelling phenomenon of mercurisulfosalicylate with time does not show a max. but does indicate a very steep gradient at the start. Dark-field study of the colloidal soln. under the microscope shows very long, interwoven, seemingly liquid crystals comparable to soap gels. An azimuth stop was used to det. the dimensions of the very small particles. Illustrations of double refraction of this material are given. Surface tension, influence of concn., temp. changes and various chlorides were studied with respect to double refraction. A good summary is given. II. *Ibid* **42**, 322-8.—Such properties as the relation between rate of streaming, aging, concn. and previous treatment can be measured quite exactly. Flowing double refraction increases steadily with increase of rate of streaming. Conc. of the sol has a strong influence on streaming anisotropy. Mechanical stirring reduces double refraction while addition of dyes increases it. Conductivity and viscosity are roughly proportional to double refraction. The properties of the acid and its salts as a prototype of a class of colloids are sketched.**

R. H. LAMBERT

Volume considerations in chemistry with respect to power of aggregation. I. TRAUB. *Ber.* **60B, 1815-6(1927).—Force of aggregation of large mols. is considered**

from a vol. viewpoint. The assocn. factor is compared to the terms for vol. in the van der Waals equation. Force of aggregation does not act as bound force from atom to atom but depends on the decrease of its covol. The latter tends to become zero for flocculation processes or submicron formation from single atoms. R. H. L.

The passivity of chromium. W. J. MÜLLER AND ERICH NOACK. *Monatsh.* **48**, 293-313(1927).—Goldschmidt's Cr was electrolyzed in H_2SO_4 soln. at diff. temps. with the following results: The Cr anode becomes passive at $\epsilon_A = \approx 0$. There exists for each Cr anode a crit. strength of current (i_k), above which the anode becomes passive. Between 0° and 35° $\log i_k$ is proportional to the temp. The current (i) decreases when i_k is exceeded, sometimes in several steps. The Cr anode remains active during the fall of i . The rapid decrease of i was registered with the aid of a Siemens' oscillograph. It is inferred that Cr dissolves first as chromous salt, which yields H^+ ions (largely removed by migration) and chromic salt. The latter hydrolyzes to $\text{Cr}(\text{OH})_3$, which seps. on the anode, thus forming an insulating layer. This layer extends over the surface and increases the c. d. till the crit. value is exceeded, when the Cr becomes passive (between $\epsilon_A = 0$ and 1.25 v.). At $\epsilon_A = 1.25$ approx. the Cr goes into soln. as chromate. H. S. v. K.

The passivity of iron mirrors. H. FREUNDLICH, G. PATSCHKE AND H. ZOCHER. *Z. physik. Chem.* **128**, 321-44(1927).—A method is given for the prepn. of iron mirrors by the deposition from $\text{Fe}(\text{CO})_5$ upon glass. A number of these mirrors were prepd. and studied in connection with the passivity of Fe towards HNO_3 . The addn. of air to a newly formed mirror produced a visible effect. The mirrors prepd. were of various thicknesses, but ordinarily uniform in any one mirror. In transmitted light they were brownish gray. The ultramicroscope showed that their structure was not continuous, and this was supported by x-ray diffraction examn., which revealed a very fine-grained structure (of α -iron), and also by elec. cond. measurements, which gave a sp. cond. of 1.4 to 1.5 reciprocal ohms for films from 16 to 63μ thick, a value only $1/7$ that of compact Fe. They oxidized in an open flame to brown transparent mirrors. Similar oxide mirrors were obtained by decompng. the $\text{Fe}(\text{CO})_5$ in the presence of air. The Fe mirrors dissolved completely in HCl and H_2SO_4 , oxidized in water in the presence of air, but remained unaffected in dichromate- H_2SO_4 for days even at 90° . Rendered passive in HNO_3 the mirrors were in general similar to passive Fe wire. Carefully protected from air, however, they showed no passivity effect, the "vacuum-mirror" (from which air had been excluded) dissolving completely in HNO_3 of all concns., whereas the "air-mirror" showed the usual passivity. The difference between the 2 types of mirrors was discernible in similar reactions towards HNO_3 vapor, but the difference was not so sharp. In contact with the test acid (HNO_3 , d. 1.20) the vacuum-mirror dissolved immediately whereas the air-mirror dissolved only after a time. The superior activity of the vacuum-mirror is designated as the "vacuum-activity," and the passivity of the air-mirror as the "air-passivity." The vacuum-activity is not destroyed by CO_2 , H_2O (vapor), or N_2 . Such mirrors remain chem. unchanged in air-free water for months though losing their mech. coherence. The time of contact with air necessary to induce air-passivity is less than 10 sec. The air-passivity is not destroyed by evacuation to 10^{-3} mm Hg. Mirrors rendered passive in HNO_3 were unaffected by evacuation, but vacuum-activity was reestablished by evacuating to 10^{-3} mm Hg and heating to 28° for $1\frac{1}{2}$ hrs. Rinsing tends to remove the passivity induced by HNO_3 . Very fine brownish membranes frequently left after the soln. of the Fe mirrors in HNO_3 were identified with the passive protective layer. These results are taken to be in accord with the oxide theory of passivity. ROBERT F. MEHL.

The stability of suspensions. II. The rate of sedimentation of kaolin suspensions containing colloidal silicic acid. WM. O. KERMACK AND WM. T. H. WILLIAMSON. *Proc. Roy. Soc. Edinburgh* **47**, 202-21(1927); cf. *C. A.* **19**, 2433.—The previous work on sedimentation in the absence of silicic acid was repeated and extended to include the effect of all alkali metals except Rb. In acid suspensions the action in inhibiting sedimentation is least in the case of Cs and greatest in the case of Na. This is in accord with the Gedroiz-Wiegner theory of base exchange in soils and stability of clay suspensions. The theory is that the p. d. of the Helmholtz double-layer is proportional to the effective distance between the layers. The highly hydrated ions such as Na are unable to approach very near the surface of the clay; they form stable suspensions. The order of stabilizing influence on clay is $\text{Cs} < \text{Rb} < \text{K} < \text{NH}_4 < \text{Na} < \text{Li}$. The ions which approach most closely to the clay and stabilize least are most difficult to displace from the clay. Normally a small concn. of silicic acid protects colloidal clay slightly. Under some conditions the effect of the silicic acid is to produce the pptn. of a film of insol. material on the surface of the particles of clay. Such films cause

abnormally rapid sedimentation. Under other conditions the silicic acids prevent pptn. In addn. to the data on alkalis, data are given on sedimentation in the presence of silicic acid by CaCl_2 , CaSO_4 , $\text{CaH}_2(\text{PO}_4)_2$, AlCl_3 , FeCl_3 and LaCl_3 in the presence of HCl ; and $\text{CaH}_2(\text{PO}_4)_2$ in the presence of H_3PO_4 and a mixt. of CaSO_4 and $\text{CaH}_2(\text{PO}_4)_2$ in the presence of HCl . Seventeen figures are given, graphically depicting the behavior of the clay under varying concns. of these salts and varying concns. of the H-ion for each concn. of salt.

F. F. BROWN

A study of stability of suspensions of dispersed coarse particles in solution. II. Determination of colloids by the help of rate of clarification. HANS WERNER. *Ber.* 60B, 1930-33(1927); cf. *C. A.* 21, 2829.—The effect of concn. of starch and ovalbumin on the rate of clearing was studied. The limits of measuring depend on the nature of the substance. Errors are due to reading and are less for the steeper curves.

R. H. LAMBERT

Studies on the flocculation of the suspension of mastic resin. A. BOUTARIC. *J. chim. phys.* 23, 851-70(1926).—Suspensions of mastic resin were prep'd. by dilg. with H_2O to one l. 40 cc. of an alc. soln. of 16.7 g. resin per l. The degree of flocculation was measured by means of a Fremy spectrophotometer, for the wave length $\lambda = 0.59$. The velocity of flocculation (v) is increased by the addn. of H_2SO_4 , KCl and CaCl_2 , with increasing concn. of the suspension; they decrease v , however, if the size of the particles in the suspension increases. The increase of the temp. decreases v when H_2SO_4 is added to the suspension, increases v with BaCl_2 and has no effect with KCl . Blue radiation accelerates v ; red radiation has a retarding effect. Agitation and the addn. of electrolytes increases v , if the concn. of the suspension is kept const. Increasing quantities of gum arabic show a protective action. Increasing quantities of gelatin increase v at first; the curve of v has a max., then decreases until it disappears; from this point gelatin has a protective action on the suspension. Increasing quantities of starch, albumin, glucose and casein accelerate v .

J. A. SZILARD

The drop number and emulsifiability. R. C. SMITH AND MISS I. C. DOW. *J. Phys. Chem.* 31, 1263-6(1927).—Ability to be emulsified depends on 2 factors: (1) ease with which the disperse phase is dispersed and (2) the stability of the resulting emulsion. The drop no. is not a true indication of emulsifiability for, being a measure of surface tension, it takes account of (1) but not of (2).

E. G. VANDENBOSCHE

Physical chemistry of color-lake formation. I. General principles. H. B. WEISER AND E. E. PORTER. *J. Phys. Chem.* 31, 1383-99(1927).—Preliminary to the study of color-lake formation, investigations were made of the effect of p_{H} on the adsorption of sulfate ion and oxalate ion, both separately and simultaneously by the hydrous oxides of Cr, Al and Fe, and the effect of Ca ion on the adsorption of the anions at const. p_{H} . The adsorption of anions is greatest at low p_{H} values, falling off rapidly on the alk. side of the neutral point and being completely nullified at a p_{H} value of 9.2. However, the hydroxyl, sulfate or oxalate ions are adsorbed in the alk. range. In Loeb's investigations on the proteins, the sp. effect of anions other than hydroxyl were overlooked since he worked with relatively low concns. of salts. From simultaneous adsorption studies it was found that the sulfate ion is adsorbed more strongly than the oxalate ion in the alk. and neutral range. The ratio is 128.0 to 1 at $p_{\text{H}} = 7$ and 1.1 to 1 at $p_{\text{H}} = 2.5$. The sum of the simultaneous adsorptions approaches a mean between their sep. adsorption at the same p_{H} , contrary to the conclusion of Mehrotra and Sen. Müller's conclusion that the taking up of anions by hydrous oxide gels is a solid-soln. phenomenon has been disproved. The relationship between p_{H} value and the pptn. concns. of sulfate and oxalate ions has been studied. Conclusions based on pptn. or adsorption data obtained with the hydrous oxides are of questionable value unless the observations were made at the same p_{H} values.

H. B. W.

Cation and anion exchange on the interfaces of permutite. HANS JENNY. *Kolloidchem. Beihefte* 23, 428-72(1926).—A discussion of the history, methods of investigation and analysis, and compn. of various permutites is given. The relations of the equil. const. and adsorption of various ions by different permutites are developed through the application of the familiar adsorption equations. A linear relation between the const. and the ion vols. is pointed out. J. investigates particularly the effect of H and OH ions on the adsorption and charge of the particles. Copious data, curves and schematic diagrams of the conditions existing on the surface of the particles are presented. Many anomalies in behavior of the permutites are explained and a modification of the Helmholtz double-layer concept is advanced.

W. J. SWENEHY

Conditions under which the classical iodine-starch reaction fails. M. J. GRAMENITZKI. *Biochem. Z.* 185, 427-9(1927).—The blueing of starch by I_2 which disappears

upon heating the soln. can be radically altered in the sense that the blue becomes more intense upon heating, provided the reaction mixt. contains KI, H_2O_2 and acid (HCl). Tincture of I_2 cannot replace the KI. It is assumed, therefore, that HI is really responsible for the bluing reaction, and is destroyed at heating temp. because of the dissocn. of the III. This view is further confirmed by the fact that the presence of acid, preventing this dissocn., makes it possible for the blue color to remain even at high temps. S. MORGULIS

Weighing of powdery substances in air and in vacuo. E. ZINTL AND J. GOUBEAU. *Z. anorg. allgem. Chem.* **163**, 105-19 (1927).—A technic has been devised for accurately weighing powders both *in vacuo* and in a gaseous atm. Comparisons are made between KNO_3 cooled from a melt and in the form of powder. The difference in wt. on a 4-g. sample is of the order of 0.04 mg. per g. of material. The app. for weighing *in vacuo* is described in detail. Tests of KNO_3 and KCl powders show that per g. of substance the difference between wt. in air and *in vacuo* is not const. and is positive for the former but negative for the latter. R. H. LAMBERT

The results of the investigation of the movement of small spheres in gases and their electric charge. F. EHRENHART. *Z. Physik* **39**, 603-6 (1926).—Previous detns. of the motion of particles of radius of less than 10^{-5} cm. are summarized. All follow the same law as larger particles. The charge of particles of radius of less 3×10^{-6} cm. is less than the so-called elementary quantum. Liquid drops have the same d as in mass. F. R. B.

The motion of solid spheres of radius up to 10^{-5} cm. and their electric charge. HEINRICH TREBITSCH. *Z. Physik* **39**, 607-22 (1926).—T. uses Se particles and comes to the conclusion of the preceding abstract. He replies to Mattauch's criticism (*C. A.* **20**, 3264). F. R. B.

The motion of droplets of high density of radius up to 10^{-5} cm. and their electric charge. MAX REISS. *Z. Physik* **39**, 623-30 (1926).—R. uses droplets of a soln. of $BaHgI_4$ and comes to the conclusion of the preceding abstract. F. R. B.

Measurement of particles below 150 μ in diameter with an interference microscope. ULRICH GERHARDT. *Z. Physik* **44**, 397-402 (1927).—The mirror of a Michelson interferometer is placed above the objective of the microscope, care being taken to have all parts exactly centered. Particles smaller than 150 μ can be measured directly with the eye or photographed as well as differences in diameter of 1%. A suitable correction for the light ring around the particles is required. F. O. A.

Mathematical methods of frequency analysis of size of particles. II. Application to silver bromide precipitate. R. P. LOVELAND AND A. P. H. TRIVELLI. *J. Frank. Inst.* **204**, 377-89 (1927).—It is demonstrated that the graphical methods of size-frequency analysis recommended in Part I (cf. *C. A.* **21**, 3001), when applied to the size-frequency measurements of a group of AgBr pptns. varying in several controlled factors, was sufficient to display relationships not otherwise obvious and to indicate the nature of their quant. expression. R. P. LOVELAND

Theory of lyophilic colloids. M. VOLMER. *Z. physik. Chem.* **125**, 151-7 (1926).—A thermodynamic theory of stable colloidal solns. is developed. J. A. SZILARD

The centenary of the discovery of Brownian motion. REINHOLD FÜRTH. *Kolloid-Z.* **42**, 197-209 (1927).—A brief but very concise history of the development of the theory for Brownian motion is given. R. H. LAMBERT

Theory of the Brownian movement for systems with several different coexisting temperatures. L. S. ORNSTEIN. *Z. Physik* **41**, 848-56 (1927).—A theory of the Brownian movement is given for systems of two or more coupled parts with different temp. It is shown that the square of the fluctuation is a linear function of the temp. J. A. SZILARD

Aerosols. V. KOHLSCHÜTTER. *Kolloid-Z.* **42**, 209-23 (1927).—A close analogy is shown between hydrosols and sols in which the continuous phase is a gas. Too narrow limits as to size of particle are not to be recommended in defining aerosols although one must differentiate between them and "aerogels." Hydrosols and aerosols differ principally in the properties of the resp. media and the elec. behavior of the particles. Data have been collected on various dispersed dusts in air showing the decrease in no. of particles with time. Photomicrographs of dust show the influence of pressure and nature of the medium on the size of particle. The charge on particles is demonstrated by showing lines of force when ZnO is allowed to deposit on a magnetized metal plate. The effect of temp. on aerosols is also discussed. R. H. L.

Atmospheric disperse systems and their physicochemical characteristics, especially those electrical. A. STÄGER. *Kolloid-Z.* **42**, 223-9 (1927).—S. discusses various atm.

disperse systems and related processes. He divides twilight into day, night and astronomical and describes them. A relation is given between polarization and extinction of the sun and sky radiation. The charge on particles may be obtained from absorption of ions, ultra-violet light, water falls and whirling dust clouds. Moisture and degree of dispersity favor the formation of a charge. Some problems are proposed for further study.

R. H. LAMBERT

The influence of the concentration of colloidal solutions on the quantity of electrolyte necessary for flocculation. A. BOUTARIC AND MISS G. PERREAU. *J. chim. phys.* 24, 496-506 (1927); cf. *C. A.* 20, 2438.—For $\text{Al}(\text{NO}_3)_3$, FeCl_3 and ThCl_4 there is a decrease in α (the min. quantity of electrolyte causing pptn.) with increased concn. of the $\text{Fe}(\text{OH})_3$ sol, while such salts as KCl , KNO_3 , K_2SO_4 and K_2CO_3 have the opposite effect. In pptg. As_2S_3 α for AlCl_3 increases and α for KCl , LiCl and BaCl_2 decreases with increased concn. It is impossible to assign a value for pptg. power to a given ion. In general the ratio α/C diminishes as the concn. of the sol increases.

E. G. VANDENBOSCHE

The possibility of modifying at will the sign of the electrical charge of colloids. A. BOUTARIC. *Rev. gén. colloïdes* 5, 585-91 (1927).—See B. and Perreau, *C. A.* 20, 3257; 21, 2086; B. and Dupin, *C. A.* 21, 1577.

A. PAPINEAU-COUTURE

Comment on the molecular weight of gelatin in cresol. R. O. HERZOG AND H. COHN. *Z. physiol. Chem.* 169, 305 (1927).—The diffusion velocity of gelatin dissolved in cresol and dialyzed against cresol shows that the particles are of considerable size. Gelatin was found to be polydisperse; hence the mean mol. wts. reported in the literature are not applicable.

A. W. DOX

The colloid chemistry of viscose solutions. III. Syneresis in viscose gels. TAKAYOSHI MUKOYAMA. *Kolloid-Z.* 42, 79-86 (1927); cf. *C. A.* 21, 3456.—"A method of studying syneresis is described in which the vol. proportion of the sepd. liquid (and therefore of the remaining solid) in the mixed system is measured. The influence of concn., alkali content, and age on this condition was observed. The velocity of syneretic sepn. increases with increasing diln. of cellulose and alkali. At const. alkali content, increasing cellulose concn. increases the velocity and magnitude of the syneresis. The reverse takes place on increasing the alkali content and keeping the cellulose concn. const. From that it follows that in diln. series in which alkali and cellulose content vary simultaneously, the shortest time to the beginning of syneresis is observed at intermediate concns." **IV. Gel coagulation.** *Ibid* 180-3.—The change in state of viscose solns., known as "gel coagulation," is described. Gel coagulation is most rapid in solns. of intermediate alk., that is about 5%. It sets in sooner the lower the concn. of cellulose in the soln. Addn. of glycerol accelerates gel coagulation while the addition of aged viscose solns. to fresh solns. hinders it. **V. The viscosity minima of viscose solutions and their change with time.** *Ibid* 350-3.—The min. in the viscosity of viscose solns. is reached more slowly the larger the amt. of alkali present. Diln. with H_2O favors the early attainment of the min. Agitation not only gives a lower viscosity but also retards the attainment of the min. All influences that increase the velocity of gelation hasten the attainment of the viscosity min. The min. viscosity results from the combined effects of desolvation and of gelation. **VI. The surface tension of viscose solutions.** *Ibid* 353-5.—The surface tension of viscose solns. is somewhat less than that of H_2O or of alkali soln. of corresponding concn. It does not change on aging. When the surface tension is measured by the stalagmometer method, the drop no. varies with the velocity of the drop formation. As the speed of drop formation is decreased, the drop no. falls off, but at very slow speeds increases again.

F. L. BROWNE

Dispersed systems of the lead halides: lead iodide, lead bromide and lead chloride.

F. VON VEIMARN, T. L. CHEN, Y. KIDA AND K. YASUDA. *Kolloid-Z.* 42, 305-9 (1927). The dispersions were made by mixing aq. solns. of $\text{Pb}(\text{NO}_3)_2$ and the Ca halides under uniform exptl. conditions. Particle size was detd. by measurements on electron micrographs of the ppts. Observations were made immediately after mixing the solns. and again 8 hrs. later. The concn. of the solns., which were used in equiv. proportions, was varied from 0.0054 N to 0.02 N for PbI_2 , from 0.67 N to 1 N for PbBr_2 , and from 0.15 N to 0.5 N for PbCl_2 . Immediately after mixing, there is a max. particle size in the ppt. at an intermediate concn. of the solns. After 8 hrs. the particle size increases continuously as the concn. decreases, the rate of increase being most rapid in the region of low concn. In the most dil. mixt., observation under the ultra-microscope shows an optically empty field at the instant of mixing, then a Tyndall effect appears and becomes brighter with the lapse of time and finally fades out again as microscopic crystals form. Among the 3 Pb halides the rule holds that, if the

specific supersatn. remains the same, the less the soly. of the ppt. the smaller the particles of the dispersed phase.

F. L. BROWNE

Preparation of colloidal silver halides by electrolysis. TH. WEREIDE. *Z. Physik* **41**, 864-6(1927).—During the electrolysis of a H halide soln. with Ag cathode, colloidal Ag halide is formed as a light cloud, which moves toward the cathode; at the same time the cond. of the soln. changes. The mobility for an electrode distance of 10 cm. and a field strength of 22 v./cm. was 450×10^{-5} cm. sec./v. cm. for a measured path length of 0.2 cm., and 300×10^{-5} cm. sec./v. cm. for 0.5 cm. The mobility is about the same as that of H ion; it is decreased by the addn. of gelatin or agar. The formation of colloidal Ag halide was observed with both a. c. and d. c.; with the latter the phenomenon is discontinuous and the border line of the Ag-halide cloud against the rest of the soln. is more diffuse.

J. A. SZILARD

Colloidal lead. DOMENICO CANASSINI. *Boll. soc. med.-chir. Pavia* **1**, 1397-1403 (1926); *Ber. ges. Physik. exptl. Pharmakol.* **40**, 598—G. has not succeeded in prepg stable colloidal Pb, either by the method of Blair Bell or by means of the elec. arc or a. c., or chemically from $\text{Na}_2\text{PbO}_2 + \text{Na}_2\text{SnO}_2$ or by heating $\text{Pb}(\text{CH}_3\text{O})_2$. The slate-gray solns. thus obtained soon turned white or yellowish, and $\text{Pb}(\text{OH})_2$ and basic carbonate were found in the ppts. which always formed.

MARY JACOBSEN

Complexities and micelles. A study of the compounds of hydro-oxy-ferric chloride as a typical example of the colloidal state. G. MALFITANO AND SIGAUD. *J. chim. phys.* **24**, 173-203(1927); cf. *C. A.* **21**, 3294.—The periodic nature of the change of FeCl_3 soln. to $\text{Fe}(\text{OH})_3$ ppt., through the colloidal phase, and the reverse change, is studied by means of the ultramicroscope. The cond. and osmotic pressure of the fractions obtained by ultrafiltration of different types of this colloid show the distinct difference in these types, and point to the truth of the theory of complexes. The structure of the dark red colloid, which loses Cl easily and in which flocculation is rapid, is thought to be $\{[(\text{Fe}(\text{OH})_3)_6\text{Fe}(\text{OH})_3]\text{Fe}\}^{++}\text{Cl}_2$. The yellow-ocher phase in which changes are slow is $\{[(\text{Fe}(\text{OH})_3)_6\text{Fe}(\text{OH})_3]\text{FeCl}\}^{++}\text{Cl}_2$, and the bright red phase that is more stable is $\{[(\text{Fe}(\text{OH})_3)_6\text{Fe}(\text{OH})_3]\text{FeCl}_2\}^{++}\text{Cl}$. The Donnan equil. and the action of multivalent ions on colloids are also correlated with the theory of increasing complexity.

AMY LE VESCONTE

Complexities and micelles. Generalization to all so-called colloids of the hypothesis of increasing order of complexity. G. MALFITANO AND SIGAUD. *J. chim. phys.* **24**, 259-68(1927); cf. preceding abstr.—Examples of the application of this theory to inorg., org. and biological chemistry are given. This theory is in accord with those which define colloids as globules of definite dimensions, since complexes of the higher order would be about this size. It explains the similarity of flocculation and crystn. suggested by Zsigmondy. The properties of proteins and starch, studied by Sgrenson, indicate that these colloids consist of complexes of a higher order, rather than a single large mol. Finally the theory is correlated with the periodic nature of at. structure.

AMY LE VESCONTE

Colloidal micellar state of gelatin. A. CHEVALLIER. *Compt. rend. soc. biol.* **97**, 484-5(1927).—Pure gelatin without salts (prepd. according to Smith, cf. *C. A.* **16**, 6), and at its isoelec. point is practically insol. in H_2O at temps. below 18° , but is sol. in abs. alc. By pptg. from this alc. soln. with H_2O or CHCl_3 and agitating, a micellar suspension of gelatin is obtained as a typical colloid. Such a suspension shows very marked Tyndall effect of the ultra microscopic granules, and these flocculate instantly under the influence of certain ions. If a soln. of gelatin is made in warm water and the gelatin is pptd. with alc., a characteristic micellar suspension is obtained.

I. W. RIGGS

Sols of barium sulfate in methanol. P. C. L. THORNE AND C. G. SMITH. *Kolloid-Z.* **42**, 328-31(1927).—The quantities of water and Ba sulfate were varied in the MeOH gels and the temp. at which coagulation occurs was found. In some cases no coagulation took place even at the h. p. Cataphoretic studies show that the particles carry a positive charge and that the concn. of added electrolytes has a profound influence. The sols behave in general like water suspensions. Peptization by an excess of ions of a higher valence is very pronounced. The viscosity of the sol is little different from that of the disperse medium.

R. H. LAMBERT

A vibrating soap jelly. E. H. BUCHNER. *Nature* **120**, 367(1927).—B. ascribed the phenomenon of a vibrating soap jelly as a crystn. to a network of crystal fibers giving rigidity sufficient to allow sound vibrations. Pitch is dependent on no. and size of crystals, which in turn depend on temp.

R. H. LAMBERT

The electric double refraction of colloidal benzopurpurin. TH. WEREIDE. *Z. Physik* **41**, 857-63(1927).—The double refraction of benzopurpurin was investigated

as a function of the time, diln., cond. and addn. of electrolytes. With increased diln. the double refraction changes more slowly than the concn.; its behavior resembles that of the elec. cond. With solns. of the same dyestuff concn. but different electrolyte concn. there is a reduction of the double refraction with increasing electrolyte concn.

J. A. SZILARD

Hydrolysis of proteins with 0.2 N acid and alkali. I. S. YAICHNIKOV. *J. Russ. Phys. Chem. Soc.* 58, 1377-83(1926).—The following proteins were treated with 0.2 N HCl and NaOH: gelatin, casein, keratin and silk. One percent solns. of protein in 0.2 N HCl or NaOH were subjected to splitting at 10° for several days and at 37°, 70° and 100° for several hrs. Five-cc. samples were neutralized with 0.2 N NaOH or HCl and further titrated by Sørensen's method. The splitting up is slower with 0.2 N NaOH or HCl than with normal acid or alkali. The splitting up with 0.2 N NaOH is faster than with 0.2 N acid. The splitting of casein with acid or alkali is slower than that of gelatin. The splitting of keratin and silk is better than that of casein and slower than that of gelatin. The equation of Schütz-Borisov $K_s = \alpha/t_{0.2}$ ($K_s = \text{const.}$, $\alpha = \text{amt. of splitting, corresponding to cc. of 0.2 N NaOH used in the formolite titration of 1 cc. of hydrolyzate, } t = \text{time}$). In hydrolyzing with acid, less acid is originally consumed than would correspond, for neutralizing, to the titer of 0.2 N alkali. The same happens with alkali. Therefore acid and alkali react with albumin; evidently intermediate compds. with protein are formed at the beginning of the hydrolysis of protein. The hydrolysis with acid requires more and more alkali for the neutralization, contrary to the alkali hydrolysis. The acid hydrolysis leads to an increase of acid compds., requiring for the neutralization more alkali. In the alkali hydrolysis the acid compds. bind the alkali (partly) and the neutralization requires a steadily decreasing amt. of acid.

A. A. BOEHTLINGK

Non-liquid disperse systems of the fatty oils. LASZLO AUER. *Kolloid-Z.* 42, 288-92(1927).—Film formation of fat oils is not an oxidation in a true chem. sense and depends on the gas concn. in the oil. A careful examn. is described of wood oil, used oil and sunflower oil as to surface tension, H-ion concn., microscopic examn., centrifuging and 1 no. The gel and sol conditions of these colloidal materials are very important in their drying properties.

R. H. LAMBERT

Selective adsorption of ions in colloidal clay. A. DEMOLON AND G. BARBIER. *Compt. rend.* 185, 149-50(1927).—In one case colloid isolated from brick clay was atd. with Ca ion by contact with $\text{Ca}(\text{HCO}_3)_2$ soln., and treated with solns. of alk. silicides, singly or in mixt. and at concns. equiv. to 2% KCl. In another case clay, freed of bases, was treated with solns. of each of the alk. chlorides, alone or in the presence of CaCl_2 . The cations of the complexes formed were detd. after repeated extr. with 0.2 N HCl. The satn. capacity of clay for cations appears const. and independent of the nature of the ion. In the case of mixts. of cations, a distribution phenomenon is observed, K and NH_4 being adsorbed in approx. equiv. amts., while Na is only slightly adsorbed in the presence of the former. The Ca of CaCl_2 , formed in reaction or introduced, limits more or less, depending upon its concn., the fixation of alk. ions. By varying the resp. concn. of each of the 4 essential ions, K, Na, NH_4 or Ca, it is possible to modify at will the degree of adsorption of each and thus produce phenomena of selective adsorption without a membrane. Similar distribution was found in mixts. of brick clay and sand.

P. R. DAWSON

Silicic acid gel and its adsorptive capacity. PAUL MAUTNER. *Kolloid-Z.* 42, 24-5(1927).—Comparisons are made of the adsorptive capacity of silicic-acid gels at various temps., for various substances and for several soln. media. A diagram is given of a plant for recovering benzene in gas manufacture. This gel will not explode in contact with liquid air and will adsorb as much gas as active charcoal.

R. H. L.

Adsorption of nitrous vapors by means of "silica gel." L. CAMBI AND L. SZEGÖ. *Ann. chim. ind. applicata* 9, 3-8(1926).—Silica gel adsorbs from mixts. of NO and NO₂ with air only the NO₂, which it transforms in part to HNO₃. The oxidation of NO to NO₂ is accelerated appreciably by the gel. The fact of a negative temp. coeff. for oxidation of NO to NO₂ in absence of the gel was verified. The velocity coeff., based on the termol. reaction, reaches its max. at 30-40° in the presence of gel satd. with NO₂.

ROBERT S. POSMONTIER

Adsorption at crystal-solution interfaces. II. Individual microscopic potassium alum crystals grown in the presence of gelatin and dyes. F. G. KEENAN AND W. G. FRANCE. *J. Am. Ceram. Soc.* 10, 821-7(1927); cf. *C. A.* 21, 3508.—Bismarck Brown in concns. of less than 0.01% decreased the rate of growth of the cube faces of K alum crystals to a much greater extent than those of the octahedral. Diamine Sky Blue (less than 0.01%) stopped the growth of cube faces without affecting the octahedral. The

adsorption depends upon both the nature of the crystal and the dye. Crystal faces, having alternating planes of like ions exhibit greater adsorbing power than those with a checkerboard arrangement of + and - ions. The ratio of rate of growth of the cube and octahedral faces of K alum has been found to be $V_{100}/V_{111} = 1.61$.

C. H. KERR

The heat of dilution of solutions of electrolytes. PHILIPP GROSS. *Monatsh.* **48**, 243-50(1927).—Theoretical. The exptl. data obtained for heats of diln. of solns. of electrolytes do not conflict with the new theory of strong electrolytes. The values of the heats of diln. are dependent on individual properties such as ionic dimensions, dielec. const. and their variation with the temp.

H. S. v. K.

The distribution coefficient and the effect of salt additions. W. HERZ AND ERNA STANNER. *Z. physik. Chem.* **128**, 399-411(1927).—A continuation and extension of work of Brown and Bury on the distribution of amines between H_2O and aromatic hydrocarbons (*C. A.* **18**, 493). Distribution coeffs. at 25° have been measured for Me_3N between H_2O and C_6H_6 , $PhMe$, m -xylene, and $PhEt$, of $MeNH_2$ between H_2O and C_6H_6 , and $PhMe$, of Pr_2NH between H_2O and C_6H_6 , and $PhMe$, of Et_3NH between H_2O and C_6H_6 , $PhMe$, and $PhEt$. These coeffs. are const. for Me_3N and Et_3NH but show a tendency to wander for $MeNH_2$, Me_2NH , and Pr_2NH . This behavior is not controlled by the basicity of the amines but is a sp. property of the amines, probably related to hydrate formation or to a difference in ionic activity. The coeffs. increase with increasing mol. wt. The effect of the mol. wt. of the hydrocarbon is small. The effects of salt addn. upon the distribution of, resp., Me_3N , Pr_2NH , $PhOH$, $BzOH$ and Me_2CO between H_2O and C_6H_6 have been detd. The effect of the salt addn. is to decrease the amt. of the distributed substance present in the water. The effect of the anions on the coeff. is in the decreasing order of Cl^- , Br^- , I^- throughout, which is the order of increasing at. vol. This is explained by the greater energy density of the smaller atoms resulting in a greater attraction for the water mols. The effect of the cations for Me_3N is in the increasing order of Li^+ , Sr^{++} , Ba^{++} , Na^+ , K^+ , which is the order of increasing at. vol. It is shown that the effect of salt addn. upon the distribution of Pr_2NH is paralleled by the effect upon the soly. of Pr_2NH in H_2O . For $PhOH$, $BzOH$ and Me_2CO the proportionality between the effect upon the distribution coeff. and the at. vol. is roughly in the order of the vols., but shows striking exceptions. No quant. explanation of these results is possible at present.

ROBERT F. MEHL

Cataphoresis in a mixed solution medium. A contribution to the theory of flocculation. J. J. BIKERMANN. *Kolloid-Z.* **42**, 203-5(1927).—A study was made of As_2S_3 in water- $PrOH$ mixts. The electro-osmotic potential is measured with concn. of KNO_3 used to dil. the sol and the crit. potential is found. Viscosity fluctuations do not affect the crit. potential. The actual relation between the dielec. const. and crit. potential is as yet not clear.

R. H. LAMBERT

The density of solutions of ammonium chloride. HANS JESSEN-HANSEN. *Compt. rend. trav. lab. Carlsberg* **16**, No. 11, 6 pp.(1927).—The ds. of aq. solns. of NH_4Cl at 18° have been detd. from 1 to 33 g. per 100 g. H_2O . The data are given tabularly and are referred to H_2O at both 18° and 4° . The data agree well with those of previous investigators.

J. H. PERRY

I. The effect of one salt on the solubility of another in ethyl alcohol solution. II. Quantitative discussion of the solubility of sodium iodide in the presence of sodium thiocyanate. F. E. KING AND J. R. PARTINGTON. *Trans. Faraday Soc.* **23**, 522-35(1927).—The influence of LiI and $NaCNS$ on the soly. of NaI in C_2H_5OH at 25° has been studied, and the conductivities and viscosities of one set of solns. (NaI and $NaCNS$) have been detd. together with soly. data. The results obtained indicate that the mutual solubilities of salts in concd. solns. depend upon more than one effect, the most interesting of which is the solv. product effect, concerning which the authors will report next.

J. H. PERRY

The theory of homogeneous normal substances and of normal and abnormal mixtures. P. N. PAVLOV. *Ukrainskii Khim. Zhurnal* **1**, 501-43(1925); *Chem. Zentr.* **1926**, II, 157; cf. *C. A.* **11**, 3136; **17**, 3119.—According to P., the van der Waals const. C is the same for all normal substances and is independent of the temp. It is moreover the same as the C of mixts. of normal substances. If this is not true, the substance is abnormal. Two new concepts are introduced: ω the no. of particles arising from 1 mol. of solute, and ϵ , the no. of mols. from 1 mol. (usually polymerized) of solvent. The van't Hoff factor i is ω/ϵ , and the law of diln. becomes $\frac{c_1}{c_2} = \frac{k(\omega + n\epsilon)}{v}$, where c_1 is the concn. of the solvates, c_2 the concn. of the non-hydrated mols., and n the no. of the polymerized mols. in a unit vol. of solvent.

C. C. DAVIS

Solubilities of the metallic derivatives of nitrosophenylhydroxylamine. II. A. PINKUS and F. MARTIN. *J. chim. phys.* **24**, 137-68(1927); cf. *C. A.* **21**, 3296.—The solubilities and properties of the comds. that cupferron forms with the cations of the first 3 analytical groups are detd. by methods previously described.

Cation	Color of ppt.	Soly. in. H_2O at 18° C. in g. at./l.	Action of acids and bases				
			HCl	HNO_3	CH_3COOH	KOH	NH_4OH
Fe^{III}	brown	3×10^{-7}	2×10^{-4}	9×10^{-4}	very feeble	feebly attacked	4×10^{-4}
Al^{III}	white	$< 1.3 \times 10^{-8}$	very feeble	feeble	very feeble	attacked	attacked
Cu^{II}	bluish gray	1.1×10^{-8}	5×10^{-4}	1×10^{-3}	very feeble	feebly attacked	soln.
Sn^{IV}	white	2×10^{-5}	$< 10^{-4}$	feeble	very feeble	soln.	attacked
V^{III}	white	3.4×10^{-5}	$< 10^{-4}$	sensible	very feeble	feebly attacked	feebly attacked
Sb^{III}	white	3.5×10^{-5}	$< 10^{-4}$	feeble	very feeble	soln.	attacked
Bi^{III}	white	4×10^{-5}	6×10^{-4}	8×10^{-4}	very feeble	very feeble	$< 10^{-4}$
Sn^{II}	yellowish	4.5×10^{-5}	$< 10^{-4}$	feeble	very feeble	soln.	attacked
Cr^{III}	white	1.2×10^{-4}	notable	notable	2×10^{-3}	soln.	attacked
Cd^{II}	white	3.6×10^{-4}	notable	notable	sensible	attacked	soln.
Zn^{II}	white	4.9×10^{-4}	notable	notable	notable	soln.	soln.
Ni^{II}	greenish white	8.9×10^{-4}	notable	notable	sensible	attacked	soln.
Co^{II}	brownish rose	1.3×10^{-3}	notable	notable	sensible	attacked	soln.
Mn^{II}	white	1.4×10^{-3}	notable	notable	notable	attacked	soln.
Hg^{II}	yellowish	notable	notable	notable	notable	attacked	attacked
Cr^{III}	dull green	notable	notable	notable	notable	attacked	attacked
Mn^{II}	rose	notable	notable	notable	notable	attacked	attacked

As^{III} , As^V , and Sb^V do not ppt. By comparing results obtained by the direct and indirect methods it is concluded that the ppts. with Ag, Cu, Cd and Zn dissoc. normally in acid soln., while ppts. with Pb, Ni and Co form complex ions or mols. The potentiometric method of detg. soly. has very limited application. Cond. may be used if the soly. is less than 10^{-5} by the direct method, or less than 10^{-4} by the indirect method. The indirect colorimetric method is the simplest and most general, but is less exact.

AMY LE VESCONTE

Selective permeability of membranes. Influence of their interstice caliber. MILLER and CROCKFORD. *Compt. rend.* **185**, 502-5(1927).—When two solns. unequally concd. are connected by means of a syphon a certain e. m. f. is developed. When diffusion occurs through a permeable membrane, the voltage is different and may be reversed. For instance the couple $KCl|H_2O$ does not give any e. m. f., because the K and Cl ions have the same mobility. When the 2 liquids are connected through a membrane of gelatin, a positive e. m. f. is generated; the reverse happens when a basic gelatin is used. This phenomenon is explained by assuming that one kind of ions is retarded in its path through the gelatin by the elec. charges covering the interstices; this hypothesis is sustained by the fact that a more concd. gelatin with narrower interstices always increases the e. m. f. The same results have been obtained with HCl, K_2CO_3 , and $LiOH$.

A. L. HENNE

The occurrence of points of inflection in the concentration-vapor pressure curves of aqueous solutions of certain electrolytes. A. J. ALLMAND. *Trans. Faraday Soc.* **23**, 14-20(1927).—Calcd. and observed values of points of inflection in the p/m curves do not agree as shown for Li, Na and K chlorides. Minima for $(p_0 - p)/m$ vs. m do not in accord. This may be due to inaccuracy of vapor pressure data and to incorrect functional relations between activity and concn. in calcg.

R. H. L.

Certain physical properties of the mixtures of hydrochloric acid solutions with sodium and potassium hydroxides. N. A. TRIFONOV, K. I. SAMARINA, V. YA. ANOSOV and I. CHERNOV. *Ann. anal. inst. phys. chim.* **3**, 441-2(1926).—Viscosity, d , n , comp. and magnetic $[\alpha]$ of mixts. of 5 N solns. of the acid and the base were measured. All the curves consist of 2 branches intersecting at the 50% point to which also corresponds the max. deviation from the additive law.

BASIL C. SOYENKOFF

Rate of diffusion and the solvent. G. MUKHIN, G. FAERMANN, I. DOLGOPOLSKI and I. LEVIN. *Ukrainskii Khim. Zhurnal* **2**, 153-7; *Chem. Zentr.* **1926**, II, 2379; Part of the researches have already been described (cf. *C. A.* **20**, 3116). The diffusion of ethylene bromide and of CCl_4 in $EtOH$, in C_6H_6 , in $CHCl_3$, in $EtOH-C_6H_6$ (1:1) and in $EtOH-CHCl_3$ (1:1) was measured. Only with ethylene bromide in $EtOH-CHCl_3$ was there an approx. proportionality between the coeffs. of diffusion and the

fluidity, in the other cases the changes in the rate of diffusion from 1 solvent to another being obviously not dependent upon the viscosity alone. C. C. DAVIS

The effect of temperature on diffusion potentials. E. B. R. PRIDEAUX. *Trans. Faraday Soc.* (advance proof) Sept. 28, 1927.—The diffusion potentials of the principal types of strong electrolytes (acid, alkali, salts of strong acid and alkali, alkali and weak acid, weak base and strong acid, and a weak acid) have been found to have temp. coeffs. which are either zero, or not more than 0.5 millivolt (except for HOAc) for the temp. range 18–25°. This result is shown to be substantiated from the relation between temps. and ionic mobilities. J. H. PERRY

Electric endosmosis with sulfur. A. GERASIMOV. *J. Russ. Phys.-Chem. Soc.* 58, 201–6; *Chem. Zentr.* 1926, II, 2282.—The endosmosis of water and dil. HCl solns. through a S membrane was studied with an app. which was essentially a copy of that of Perrin (*J. chim. phys.* 2, 601). The thickness of the S layer was 18 cm. and the diam. 2.10 cm. The transport of the water was found to depend upon the time, for the potential distribution in the tube varied during the expts. as a result of changes in the concn. The new diaphragm apparently became more highly charged in very dil. HCl solns. than it did in water, which however might have been caused by a sort of "conditioning" of the diaphragm, for pure water also passed better through such a "charged" diaphragm than through a diaphragm not in this condition. Repeated passage of water did not change the activity of the membrane. Aside from the phenomena manifest in this "conditioning," the charging of S by HCl decreased continuously, to an extent which increased with the concn. of the HCl soln. C. C. D.

Corrections for the determination of ion concentrations in very dilute hydroxide solutions. ERICH LAUE. *Z. anorg. allgem. Chem.* 165, 305–24 (1927).—In view of the fact that in most cases the only contamination in cond. H_2O is H_2CO_3 , L. suggests that instead of using H_2O of high purity ($K = 0.06 \times 10^{-6}$) normal cond. H_2O ($K = 1.20 \times 10^{-6}$) be used with application of the correction $\beta = \Delta K - K_w$, in which ΔK is change in cond. due to H_2CO_3 . It is derived from the equation $1000 \Delta K = \Delta_{K_2}([K^+]_w - [K^+]_a) + \Delta([A^-]_w - [A^-]_a) + \Delta_H([H^+]_w - [H^+]_a) + \Delta_{HCO_3}([HCO_3]_w - [HCO_3]_a) - \Delta_{CO_3}[CO_3]_a - \Delta_{OH}[OH]_a$, K_a and A are cation and anion, resp. of the electrolyte being investigated; x = concn. of electrolyte if dissolved in pure H_2O ; w = when in cond. H_2O ; and e = actual concn. in soln. At the dil. solns. used less than 0.001 N complete dissocn. of all salts and bases is assumed. In cases of hydroxide solns. of fixed concn. (I) β is relatively large and positive in cases of satd. solns. in contact with solid, (II) β is approx. $-(1/3)$ dissocn. const. of H_2O . In II a negative correction α , which may be of considerable magnitude, must be applied for the concn. of the cation of difficultly sol. hydroxides $\alpha = \frac{([K^+]_a - [K^+]_w) \cdot 100}{[K^+]_a}$.

When soly. product = 10^{-12} $\alpha = -96\%$.

Conductance of hydrogen and hydroxyl ions at infinite dilution. A. FERGUSON AND I. VOGEL. *Phil. Mag.* [7], 4, 300–5 (1927); cf. *C. A.* 20, 323.—The most probable value for the conductances at infinite diln. of H^+ at 25° and of OH^- at 18° are 349.05 and 175.4, resp. GEORGE GLOCKLER

The reaction of sodium chloride if added to a solution of litmus and mercuric chloride. W. O. MOOR. *J. Am. Chem. Soc.* 49, 2355–7 (1927).—By dissolving some $ZnSO_4$ in a dil. soln. of blue litmus an easily reproducible soln. of violet litmus is obtained. 4–5 drops of a $HgCl_2$ soln. added to this gives the color a reddish cast. On adding quickly to this reddish soln. 1 cc. of satd. NaCl soln. the resulting liquid becomes blue, then slowly changes to violet. E. R. SCHIERZ

The viscosity of alum solutions. M. BOBTELSKY AND MALKOWA-JANOWSKAJA. *Z. anorg. allgem. Chem.* 165, 249–52 (1927).—The viscosity of solns. of K_2SO_4 and $Al_2(SO_4)_3$, and of equimol. mixts. of the two, is measured for concns. 0.05 M to 1.10 M and temps. 15°, 35° and 55°, the results being given in tabular and graphical form. The differences between the viscosity of each soln. and that of water may be added to give the difference for the mixt., which is strictly equal to that for a corresponding soln. of crystd. $KAl(SO_4)_2 \cdot 12H_2O$. Further measurements with H_2SO_4 in place of K_2SO_4 gave no evidence for complex-ion formation. Thus a soln. of crystd. alum behaves, as far as its viscosity is concerned, like a mixt. of K_2SO_4 and $Al_2(SO_4)_3$. F. A. J.

The creeping of solutions. E. R. WASHBURN. *J. Phys. Chem.* 31, 1246–8 (1927).—When an evapg. soln. wets the walls with which it is in contact it rises on them above the body of the liquid. On evapn. of this film there is formed a capillary space bounded by the crystal crust and the wall. Soln. rises through this space to a new height, causing the crust to grow. In some instances the crust climbs over the top

of the walls and down on the outside so that liquid is siphoned out of the container. Climbing does not occur if the walls are greasy. E. G. VANDENBOSCHE

Molecular scattering of light in aqueous solutions. I. S. VENKATESWARAN. *Indian J. Physics* 1, 235-44(1927).—The scattering of light by aq. solns. of H_2SO_4 , HNO_3 , and HCl has been detd. The optical anisotropy of the HNO_3 mol is much greater than that of the H_2SO_4 mol. This agrees with Bragg's results on the birefringence of cryst. nitrates and sulfates. As regards the scattering of light these solns. behave more like single liquids than binary mixts. II. *Ibid* 393-400.—Solns. of acetic, propionic and butyric acids have been investigated. In contrast with the acids of I they show the concn. scattering characteristic of mixts., its magnitude increasing rapidly from acetic to butyric acid. For butyric acid the variations of the intensity and depolarization in proceeding toward the crit. soln. point are in complete accord with theory. R. L. HERSHEY

Compressibilities of aqueous solutions of some fatty acids. S. VENKATESWARAN. *J. Phys. Chem.* 31, 1521-5(1927).—The adiabatic compressibilities of solns. of formic, acetic, propionic and butyric acids were detd. at pressures of from 1 to 2 atm. with a piezometer and the isothermal values were calcd. The results are tabulated.

R. R. SMITH

The activity of zinc chloride in concentrated solution. F. FOXTON AND W. J. SMITH. *Trans. Faraday Soc.* 23, 480-8(1927).—A type of electrolyte was chosen for study intermediate between aq. solns. and fused salts. Vapor pressure measurements of $ZnCl_2$ solns. from 0 to 40% chloride content were made at about 60° and 80° with an accuracy of ± 3 mm. Together with e. m. f. data the heat of formation of $ZnCl_2$ at 20° has been calcd. to be 97,300 cal. Abnormal results in cells with liquid junctions were obtained; they are believed to be due to complex-ion formation. The work is to be continued. R. H. LAMBERT

The significance of the activity coefficient. MERLE RANDALL. *Trans. Faraday Soc.* 23, 498-502(1927).—If the compn. of a soln. be expressed in terms of the mol. wts. of arbitrarily chosen mol. species, then the activity coeff. gives a simple numerical statement of the deviation of this soln. from the laws of the perfect soln. The laws based on different mechanistic hypotheses all tend to approach the law of the perfect soln. as a limit. The activity coeff. enables one to bring into agreement the various colligative properties of a soln., and is therefore a test and guide to the adequacy of different mechanistic proposals. J. H. PERRY

Methods of calculation of activity coefficients. MERLE RANDALL. *Trans. Faraday Soc.* 23, 502-7(1927).—Methods of calcg. the activity coeff. of the solute from that of the solvent are described, in which the results from all the different methods are on the same graph. This is accomplished by the use of the graphs of j/m vs. m and of $h/m^{1/2}$ vs. $m^{1/2}$, in which j is a property of the solvent and is equal to $1 - (\theta/\nu\lambda m)$, where θ is the f.-p. lowering or the b.-p. raising, ν is the no. of mols. formed per mol. of the solute, λ is a const. = 1.858, and m is the molality; h is the divergence function and equal to $1 + (55.51 \ln a_1)/(\nu m)$. The results of the previous methods and those from measurements which give the activity of the solute are correlated so as to superimpose the graphs and so select the best av. values. This is accomplished by the use of the $(\log \gamma + \text{const.})$ vs. $\mu^{1/2}$ graphs, where γ is the activity coeff. and μ is Brönsted's function. (C. A. 18, 779). A method of interpolating the activity coeffs. of strong electrolytes is suggested, wherein the graphs of $(\log \gamma) \mu^{1/2}$ vs. $\mu^{1/2}$ are used. J. H. PERRY

Calculation of activity coefficients from conductivity measurements. C. W. DAVIS. *Phil. Mag.* [7], 4, 244-50(1927).—On the Debye-Hückel theory $\log \gamma = -0.5 \sqrt{C_i}$, where γ is the square root of the product of the activity coeff. of cation and anion and C_i is the ionic concn. D. finds from cond. measurements for the const. 0.5 in the above equation 0.382 from formic acid, 0.393 from acetic acid and 0.372 from α -chloroacetic acid. Randall and Vanselow find 0.393 from f.-p. measurements on HCl (C. A. 19, 428). Nonhebel finds 0.39 from e. m. f. measurements on HCl at 25° (C. A. 21, 847). GEORGE GLOCKLER

The activity coefficients, ionic concentration and kinetic salt effects of formic acid in neutral salt solutions. H. S. HARNED. *J. Am. Chem. Soc.* 49, 1-9(1927).—The activity coeffs. of HCO_2H calcd. from results on the rate of hydrolysis of HCO_2Et in neutral salt soln., parallel previous detns. of the activity coeffs. of water in salt soln. The anomalous nature of the activity coeff. of OH^- is pointed out and is considered due to specific influence of the same type as that which produces undissocd. mols. F. R. B.

Activity coefficients of electrolytes. I. A bivalent salt and the ion attraction

theory. U. B. BRAY. *J. Am. Chem. Soc.* **49**, 2372-80(1927).—A description is given of a reproducible Pb-Pb sulfate electrode and the mean ion activity coeffs. for ZnSO_4 at 25° for dilns. from 0.0001 *M* to 3.5 *M*. Up to 0.005 *M* the results are in agreement with the Debye-Hückel ion attraction theory but at higher concns. important deviations arise.

A. P. SACHS

Report on conductivity of strong electrolytes in dilute solutions. P. DEBYE. *Trans. Faraday Soc.* **23**, 334-40(1927).—A demonstration of the adequacy of the inter-ionic attraction theory to explain the Kohlrausch law, cond. is proportional to the square root of the concn. The velocity of an ion in a conducting electrolyte is affected in 2 ways by its ionic atm.: (1) Movement of the ion causes a dissymmetry between the ion and its atm. and the electrostatic forces which are thus brought into play contribute a considerable amt. to the apparent frictional resistance of the ion. (2) The surrounding ions cause a movement of the solvent when an external field is applied (electrophoresis). Considering these 2 factors, D. deduces a formula wherein the migration velocity at infinite diln. is proportional to the reciprocal of the radius of the ionic layer and hence to the square root of the concn.

R. B. GIBSON

Report on a revision of the conductivity theory. L. ONSAGER. *Trans. Faraday Soc.* **23**, 341-9(1927).—O. takes the theory of Debye for cond. of electrolytes (cf. preceding abstr.) and modifies it by introducing a correction for the Brownian movements of the ions. He obtains a mobility formula which eliminates the arbitrary consts. from the limiting formula for cond. at infinite diln. The theory is tested by numerous examples and the agreement with the observed variation of cond. with concn. is excellent.

R. E. GIBSON

The ionization of some typical strong electrolytes. D. A. MACINNES AND I. A. COWPERTHWAIT. *Trans. Faraday Soc.* **23**, 400-4(1927).—From transference and conductance measurements the authors conclude that if the alkali chlorides and HCl are completely dissociated then HNO_3 and NH_4NO_3 belong to this class also. NaNO_3 , KNO_3 and AgNO_3 are not completely dissociated.

R. E. GIBSON

The activity coefficients of protein ions. G. S. ADAIR. *Trans. Faraday Soc.* **23**, 536-7(1927).—The activity and osmotic coeffs. for both isoelec. and ionized hemoglobin have been obtained in the molality region of 0.0002 to 0.005. The abs. values of the coeffs. do not agree with the Debye and Hückel formulas because both increase as the protein concn. increases. In the D and H formulas, the free energy of an ion is treated as the sum of two terms, the first being equal to the free energy of an ideal gas mol. and the second being dependent upon the elec. forces. It would seem probable that a third term must be added for large ions such as hemoglobin.

J. H. PERRY

The influence of a dissolved substance on the density of a solvent. H. GRUNERT. *Z. anorg. allgem. Chem.* **164**, 256-62(1927).—Naphthalene, phenanthrene and iodine were dissolved in $(\text{CH}_3)_2\text{CO}$, C_6H_6 , $\text{C}_6\text{H}_5\text{CH}_3$, CS_2 and CCl_4 . With those solvents of sp. gr. less than naphthalene the density of the soln. increased with the solute content. The solvent with a gravity higher than that of the solute gave a soln. whose density decreased with the quantity of dissolved substance. The plot of the d differences against percent solute is a straight-line function. At 20°, 40° and 60° the plot is practically the same. Phenanthrene acted in like manner. With I_2 the difference between the d of soln. and solvent increases approx. with the I_2 content. The soln. vols. of these solns. were detd., and it was found that they increased with temp. in all solvents.

C. E. P. JEFFERYS

New ideas in the theory of electrolytes. TEOFILO ISNARDI. *Anal. asoc. quim. Argentina* **14**, 193-238(1926).—An exposition of the Debye theory of electrolytes, its consequences and recent developments.

R. H. LOMBARD

Graphical methods and empirical formulas for the study of electrolytic dissociation. ERNESTO DENINA. *Notiz. chim.-ind.* **2**, 191-7(1927).—A graphical method of representation of the ideal dissociation formula is developed, and diagrams which show variations in the dissociation const. with variations in the diln. are discussed. It is shown to be advantageous to use logarithmic diagrams, in which the abscissas are the logarithms of the "total" ionic or neutral mol. diln. and the ordinates are the logarithms of a characteristic function of the degree of dissociation α , thus: $\log \eta_0 = \log[\alpha^2/(1-\alpha)]$, $\log \eta'_0 = \log[\alpha/(1-\alpha)]$, and $\log \eta''_0 = \log[\alpha/(1-\alpha)]^2$. Certain empirical formulas are derived from theoretical formulas by introducing an exponent other than 1, which varies from electrolyte to electrolyte. Various applications of these formulas to individual electrolytes are given. The expressions which can be derived from linear combinations of the preceding formulas are then considered, and a method for the graphical calcn. of the consts. is presented. It is shown that numerous known empiri-

cal formulas can be reduced to the types which the graphical methods and the accompanying discussion suggest as simple modifications of the principal 3 forms in which the ideal law can be expressed, and according to which the cause of the anomalies is attributed to ions, to neutral mols. or to the electrolyte as a whole in the dissolved state. New empirical formulas to complete those already known are derived to show the way in which the behavior of electrolytes approaches that of the ideal case when the diln. becomes sufficiently great. The phys. significance of the formulas discussed must be sought in the complexity of equilibria in the soln., for which arbitrary models can be developed. Combining then the various models, it is possible at times to supplement the elements of truth which they contain and thus obtain formulas which approach closer to the facts.

C. C. DAVIS

The amphoteric character of silver hydroxide. ERICH LAUE. *Z. anorg. allgem. Chem.* 165, 325-63 (1927).—From detns. of the soly. of AgOH in cond. H₂O, dil. NaOH KNO₃ solns. L. concludes that AgOH is amphoteric. Soly. of AgOH in H₂O at 20°, 25° is 1.14, 1.20, 1.39×10^{-4} eqivs. per l, resp., detd. by cond. at 25° by redposition 1.31×10^{-4} (corr.). In 0.01, 0.10, 0.50, 2.00 N KNO₃ solns. soly. is 0.190, 2.08 and 2.82×10^{-4} eqivs. per l, resp., at 25°. In alk. solns. 0.10, 0.506, 2.26, 5.20 N the soly. is 0.30, 0.91, 1.50, 2.86 and 4.23×10^{-4} eqivs. per l. These are all lower than those in the literature but L. thinks they are more accurate use of the correction which he has applied. From the soly. in H₂O the heats of neutralization, 17 cal./mol. at 18°, 20.2 cal./mol. at 25°. Mech. stirring of AgOH with H₂O did not seem to be peptized. This was removed by filtration through a Jena sintered glass filter which had been "stuffed" with fine Ag₂O. By means of Bjerrum's theory dissociation values have been calcd., $\text{Ag}^+ = 6-8\text{H}_2\text{O}$, $\text{AgO}^- = 11\text{H}_2\text{O}$. Activity of AgOH is 1.85×10^{-8} , that of argentic acid 2×10^{-8} ; hence the ratio of the two is 1.10×10^{-10} . Kossel's conception of inorg. amphoteric hydroxides is extended to the whole periodic system.

E. R. SCHIERZ

The Storch equation. A. FERGUSON AND I. VOGEL. *Phil. Mag.* [7], 4, 1-17 (1927).—Discussion of application to electrolytes of various types of mass-law equation, either with const. exponent or in a more general form with the exponent n considered a linear function of the concn. The equation considered is $((Ca)^n)/(C(1-\alpha)) = K$ with the usual significance of symbols. F. and V. find that it applies to certain electrolytes up to normal concns. For others it is valid to concns. of the order of 0.01 M and for a third type they show that the assumption $n = a + bC$ is applicable. On this basis diln. law is tested at limiting dilns.

GEORGE GLOCKLER

The influence of gum acacia on the specific conductivity of binary electrolytes and the effect of binary electrolytes on the viscosity of gum acacia solutions.* J. F. SPENCER AND R. DRUMMOND. *Kolloid-Z.* 42, 332-5 (1927).—Observations of viscosity and sp. cond. were made in solns. contg. gum acacia and one of the following electrolytes: HCl, NaCl or BaCl₂. The concns. of gum acacia were varied from 0 to 25% and at each concn. of gum, the concn. of electrolyte was varied from 0 to 0.5% for HCl and 0 to 1% for NaCl and BaCl₂. The viscosity was always decreased by the addn. of electrolyte. In some regions of gum concn. the viscosity passed through a min. with increasing electrolyte concn.; in other regions of gum concn. the viscosity decreased continuously. The sp. cond. of the mixt. of gum acacia and electrolyte was always less than the sum of the conductivities of the gum and electrolyte solns. taken separately.

F. L. BROWNE

Calculation of equivalent conductivities of strong electrolytes in aqueous solution at 0°, 18° and 25°. A. FERGUSON AND I. VOGEL. *Phil. Mag.* [7], 4, 233-42 (1927); cf. *ibid.* 20, 323.—In the equation $\lambda_0 = \lambda + BC^n$, F. and V. believe that both the const. B and n are variable from one electrolyte to the other. C = concn., λ = equiv. cond. at concn. C . By their methods of obtaining n and B they have calcd. λ_0 for various electrolytes.

GEORGE GLOCKLER

Base exchange in permutites. GEORG WIEGNER AND HANS JENNY. *Kolloid-Z.* 42, 268-74 (1927).—Base interchange depends on ionic interchange, which in turn depends on hydration of ions in soln. The higher the valence, the greater becomes the chg. charge. The relation between exchange in ions and at vol. of the ions is shown by the alkali metal group. The dehydration with alc. is a function of ionic interchange. A new formula for an equil. exchange shows that $(a - c) = k'(c/a - c/b)$, which shows the independence of diln. on the equil. not apparent in the Freundlich equation.

R. H. LAMBERT

The activity of hydrogen ion in mixed solvents. HORACE MILLET. *Trans. Faraday Soc.* 23, 515-22 (1927).—With the idea of detg. the influence of the solvent en-

vironment on activity, the H-ion activity of HCl and of picric acid has been detd. in $C_2H_5OH-H_2O$ mixts. by the e. m. f. method. Detns. were made for H-ion activities in $C_2H_5OH-H_2O$ mixts. contg. 0.05 *N* HCl, alone and in the presence of sucrose at 25° and 30° by means of the cell, $H_2 | 0.5 \text{ } N \text{ HCl-alcohol-H}_2O | \text{satd. KCl} | \text{normal calomel electrode}$. In the measurements with picric acid, a Biilman electrode was used. The min. activity obtained with HCl is shown to lead one to suspect the existence of a $C_2H_5OH \cdot 3H_2O$ compd. The rapid fall observed with the H-ion activities in mixts. rich in C_2H_5OH when the H_2O content is gradually increased is shown to be similar to the corresponding fall in H-ion mobilities. This effect is probably connected with the hydration of H ion. On this basis a calcn. is made of the H-ion activities that would be expected and the data obtained agree with the observed values. An empirical relationship of $k = (aD^2)/\Lambda$, where "*a*" is the activity coeff. of the H ion, *D* is the dielec. const. of the medium; Λ , is the equiv. cond. and *k* is a const. is found to be valid for HCl in $C_2H_5OH-H_2O$ mixts. J. H. PERRY

The electronic theory of valency. V. The molecular structure of strong and weak electrolytes (a) complete ionization. T. MARTIN LOWRY. *Trans. Faraday Soc.* 23, 508-15(1927); cf. *C. A.* 18, 2273.—Compds. in which neutralization of the ionic charges is prevented by the valence laws generally behave as "strong electrolytes" in soln. Poorly conducting solns may be obtained by dissolving a salt in a medium of low dielec. const. when abnormal variations of cond. with diln. are generally noticed. This is, of course, dependent upon the acceptance of the general validity of Walden's rule that a dissolved salt gives a definite value of Λ/Λ_∞ at a diln. which is inversely proportional to the cube of the dielec. const. of the solvent. Many fused salts are good conductors. Some of these, however, give values for the coeff. of ionization of over 100%; this may be due to the formation of ionic aggregates which have multiple charges. Some fused salts are, however, poor conductors, although the theory of valency would indicate that they should be completely ionized. The most probable explanation of this apparent anomaly is that the crystal lattice is broken down into neutral ionic doublets as soon as the material is fused. This effect is most likely to appear in salts which are easily vaporized, that is, those which readily dissoc. into volatile neutral doublets. From the point of view of the theory of complete ionization, the term "hydrolysis" has no real significance, unless the H ion or OH ion of water can be fixed by one of the ions of the salt with the formation of a covalent compd. A typical example of this case is NH_4Cl wherein the hydrolysis depends upon the conversion of NH_4OH into a covalent compd. An example of a "hydrolysis by dehydration" is the hydrolysis of a salt of a weak NH_4 base; this is then a thermal dissocn. into which H_2O does not directly enter. J. H. PERRY

Notes on the Soret effect. A. E. PORTER. *Trans. Faraday Soc.* 23, 314-6(1927).—The results of Tanner (*C. A.* 21, 1395) obey the equation: $d(nT^{1/2}) = 0$ (1) (*n* = mol. concn. at equil. and *T* = abs. temp.), deduced for the equil. existing when the local concn., at distance λ (the mean free path of solute mols.) in front and behind an inter-surface, is const. By introducing a factor *i*, dependent on the ionization, the small deviation, amounting to a max. of 0.007 for a drop of 20° in varying concns. of KCl, is negated and the equation becomes: $d(nT^{1/2})/nT^{1/2} + di/i = 0$. For H_2SO_4 , *di/i* is considerable. The temp. gradient is practically uniform. The concn. gradient is not, and is given by: $\Delta n/n = -\Delta T/2(T_1T_0)^{1/2}$, where T_1 and T_0 are the extreme temps., Δn and ΔT the differences in extreme values and *n* is defined as the normality. The cause of differences for different cases in the Soret effect is probably due to variations in the factor *i*. J. BALOZIAN

The solid solutions of cholesterol. P. A. MANDEL AND N. S. KURNAKOV. *Ann. inst. anal. phys. chim.* 3, 464(1926).—Cholesterol can be obtained in solid soln in substances of higher m. p. like naphthalene, AcOH, $C_{17}H_{35}COOH$, $p-NH_2C_6H_4CH_3$, α - and β -naphthylamines. Cholesterol also dissolves β -naphthol, β -naphthylamine, etc. BASIL C. SOYENKOFF

Chemical action at an interface: the production of acidity in neutral salt solutions. N. V. ACHAR AND F. L. USHER. *J. Chem. Soc.* 1927, 1875-82.—Development of acidity in neutral salt solns. where no detectable quantity of acid can be extd. is shown to be due to a chem. interaction of the ionic type. This is qualified by the fact that one kind of atom is non-diffusible. Studies were made on stearic acid suspensions in K_2SO_4 solns. Acidity decreases with diln. of the suspension and decreased concn. of K_2SO_4 . Observed acidity is probably due to exchange of the cations of the salt with H ion formed from dissociating mols. in the surface of the insol. acid. R. H. LAMBERT

The application of surface-tension measurements to the calculation of the heats

of dissolution of two partially miscible^a phases. RENÉ AUDUBERT. *J. chim. phys.* 24, 427(1927).—A. has already shown (*C. A.* 15, 1446) that the heat of vaporization of a liquid can be expressed as a function of its surface energy, and has demonstrated the validity of the expression he employed by calcg. mol. diams. comparable with those obtained from the kinetic theory and x-ray spectroscopy. The same reasoning is now applied to calc. the heats of dissoln. of two partially miscible liquids, since this may be regarded as work done against the force of cohesion. For the system water-ether a value of 6000 cal. is calcd. against 5800 cal. observed for the latent heat of dissoln.

W. T. RICHARDS

The mass unit of chemical potential. W. D. BANCROFT. *J. Phys. Chem.* 31, 69-80(1927).—The abs. value of chem. potential is never measured, only its change due to chem. reaction. The unit should be the one appropriate to that reaction.

F. R. BICHOWSKY

Analysis of the time laws of complex chemical reactions. MAX BODENSTEIN. *Ann. Physik* 82, 836-40(1927).—Reply to Skrabal's criticism (*C. A.* 21, 3525) of a paper by Herzfeld (*C. A.* 15, 1440).

JOHN T. STERN

The theory of the velocity of chemical reactions. FRANCESCO GIORDANI. *Rend. accad. sci. Napoli* 32, 70-82(1926).—A value of the critical increment E , deduced by Arrhenius' formula, from the variation of the reaction velocity k , as a function of T , will be in error if polymerization exists which is not taken into account. In such a case, it is shown that $E_1 = E + Q$ where E_1 is the effective value and E the exptly. observed value. Since, for polymerization reactions, Q is usually positive the observed critical increment will be less than the actual, and the value of ν , the frequency of the exciting radiation, will be too small. Such an error might occur in the case of III, where there is good reason to think that the reaction is the monomol. decompn. of the polymerized mol. H_2I_2 . It is suggested also that the no. of oscillators may not be equal to the no. of mols., but to the no. of valence electrons. If r is the no. of valence bonds in the ordinary chem. sense, it is proposed that the absorption of energy may be proportional to $\nu_p^{1/r}$, whence, $k = (\pi c^2/3m h \nu) (\eta \nu_p^{1/r})$. By applying this to data, at 672°, for the thermal, monomol., decompn. of PH_3 , $r = 3$, $k = 29.01 \times 10^{-3}$ as compared with exptl. value, 10.2×10^{-3} . The corresponding value for λ is 0.125×10^{-4} , which agrees better with the optical data than does that calcd. by the old method, 0.375×10^{-4} . For the monomol. decompn. of N_2O_6 , $r = 2$, the calcd. value of k is 1.3×10^{-4} , the exptl. value is 0.34×10^{-4} , and the calcd. value of λ is 0.582×10^{-4} . For the bimol. decompn. of O_3 , $r = 6$, λ is calcd. to be approx. 320μ as compared with the observed absorption band at λ 225 μ .

R. H. L.

Kinetics of reactions in crystal powders. KURT FISCHBECK. *Z. anorg. allgem. Chem.* 165, 46-54(1927).—Reactions involving solids can be divided into those which relate to changes of a single cryst. species and those which involve changes in 2 or more cryst. species. The first group has been studied intensively, and attention is here directed to the second class. The significant characteristic of these reactions is that they all involve changes in the lattices of one of the crystals to permit the introduction of other elements. The velocity of these reactions would be proportional to the diffusion if the reaction velocity proper were very great compared with the diffusion process. However, kinetic considerations based on diffusion alone do not yield satisfactory results. Dunn (cf. *C. A.* 20, 2934) from thermodynamic considerations has derived the following equation: $d \ln K/dT = -Q_s/RT^2$ or $K = e^{B-Q/RT}$ in which K is the velocity const. and Q is the heat of unlocking the lattice. This may be rewritten in the form $dy/dt = (e^{B-Q/RT})/y$. F. then considers the special forms which this equation takes for isothermal and adiabatic conditions, etc.

A. W. K.

The reaction between silver and sulfur mixed in the form of a crystalline powder. KURT FISCHBECK AND WERNER JELLINGHAUS. *Z. anorg. allgem. Chem.* 165, 55-8 (1927). Expts. on Ag and S were carried out as a verification of the theory just given (cf. preceding abstract). Purified Ag and S were mixed in powder form, the particle diameters averaging about 0.001 mm. and were compressed in a tablet machine under a pressure of about 1000 kg./sq. cm. The tablets were then heated in the air in a steam-heated chamber and analyzed after different lapses of time by extg. the S with CS_2 . At 110° and 98° the action was rapid and led to audible explosions in 1 or 2 min. Expts. were made at 110°, 98°, 78°, 65°, 55°, 45°, 38° and 22°. At the lower temps. the data were quite consistent, so that the % conversion plotted against the square root of the elapsed time gave straight lines from which the av. value of k was taken and another graph made plotting $\log k$ against $1/T$, the points falling approx. on a straight line up to 98°. From this graph the value of Q was calcd.; and allowing for

the vapor pressure of S, the energy required to open the Ag₂S lattice amounts to 6600 cal. per mol. This is in fair agreement with calcn. made from Köster's data (cf. *C. A.* 17, 14) which gave 6400 cal. as the value. The reaction velocity of the whole reaction increased 5.47 times for 10° rise in temp. whereas the diffusion const. increased about 1.65 times.

A. W. KENNEY

Reaction in the solid state at high temperature. I. Rate of reaction for an endothermic change. WILHELM JANDER. *Z. anorg. allgem. Chem.* 163, 1-30 (1927).—An endothermic and an exothermic reaction can be differentiated by plotting a rate of reaction curve and noting its shape. The theory for the reaction between 2 kinds of crystals is presented. The rate of reaction is dependent on temp. and size of crystals. A description of the app. used for expts is given. The rate of reaction is measured for BaCO₃ and CaCO₃ with SiO₂ and for CaCO₃ with Mo oxide. The effects of temp. and of grain size were studied. Excellent agreement is found between exptl. data and theoretical calcs.

R. H. LAMBERT

A very general time law of chemical kinetics and its significance. The velocity of hydrolysis of the organo-oxides. ANTON SKRABAL. *Z. Elektrochem. angew. physik. Chem.* 33, 322-48 (1927).—It is set up as a general expression for the velocity of the many reactions taking place with H₂O in aq. soln. that $dx/dt = (k_w + k_a h + k_b i) \times (a - x)$ (1), where $(a - x)$ is the instantaneous concn. of the substance reacting with H₂O, h = H-ion concn. and i = OH-ion concn. $hi = w$, the ionization product of water. A mathematical treatment of this expression enables generalizations to be drawn as to the conditions of min. reactivity or max. stability. If $a - x$ in the above expression = 1, the velocity const. k , becomes $k = k_w + k_a h + k_b i$. If then a curve is plotted whose abscissas are log h and ordinates are log k , the curve will, in general, consist of 3 parts, a descending portion, a horizontal portion and an ascending portion, all practically rectilinear. The abscissa of max. stability lies at the center of the horizontal portion. It is possible for this generalized curve to take different forms in which one or more of the sections of the curve are absent: e. g., the curve may be a straight horizontal line in case the velocity is independent of the H-ion concn.; or it may be a straight descending line. The abs. values of the 3 const. given in equation (1) differ greatly for different reactions and in many cases cannot all 3 be directly detd. Euler's theory of the mechanism of hydrolytic reactions is criticized at length. It is shown mathematically that according to his assumptions the general curve in the log k -log h plane would have a different shape from that described above and S. observes that there has been no evidence to show in any single case the existence of certain parts of these curves. Further, Euler's conditions of max. stability are shown to be incorrect. They do not necessarily correspond with the isoelec. point. The Euler hypothesis cannot, in many cases, be verified experimentally; and in other cases it is ambiguous. It rested, however, on the basis that in the numerous cases of acid and basic hydrolysis where it had been used, any deductions based on it had not proved to be in error. S. specifically denies this; and states that it is contrary to experience, that in all cases the ions react more rapidly than the undissoc. esters and cites examples. The hydrolysis of Et acetate by acids is 10,000 times more rapid than that of the Et₂O and the hydrolysis of Ac₂O proceeds not more slowly but 50 times more rapidly than that of Et acetate, contrary to the deductions which would be drawn from Euler's work. The real nature of the catalytic reactions in which water plays the part of a reactant is not known and none of the numerous theories of the mechanism which have been advanced is satisfactory. S. sets himself the problem of detg. from constitutional formulas the numerical values of the 3 velocity const. in equation (1) and considers the general reaction, $XOY + HOH = XO + YO$, in which X or Y may be either alkyl or acyl. This then includes in the term organo-oxides the anhydrides, ethers, esters, acids and alcs. The data on the alk. and acid hydrolysis of these different classes of compds. are discussed and it is pointed out that the organo-oxides whose hydrolysis leads to bases are catalyzed by H ion, whereas those which yield acids are catalyzed by OH ion; k_a and k_b can be calcd. for a esters. Whereas k_a for different esters is relatively const., k_b varies over extremely wide limits, from about 1 to 880,000. S. considers at some length the alk. sapon. of

reacting material, so that there may be not only steric hindrance but steric assistance of sapon. Certain relationships between the const. such as $V = k_b/k_a$ and $W = k_w/2\sqrt{k_a k_b w}$ characterize the hydrolysis curve. The abs. value of k_w may vary between the largest value so far detd., 1.6 for maleic anhydride, and the smallest so far measured, 9.2×10^{-9} for Et acetate; k_w for Et₂O is presumably of the order of 6×10^{-14} . It is possible to est. by analogies the values of the individual const. for a no. of

simpler compds., but the no. of factors¹⁰ which influence the velocity, such as conformation, etc., makes the calcn. extremely complicated. The acetals form a class closely related to the organo-oxides and the fact that the rate of their hydrolysis can be approx. predicted forms a test of the S. theory. A. W. KENNEY

Decomposition of glycylglycine by alkali. I. S. YAICHNIKOV. *J. Russ. Phys.-chem. Soc.* 58, 1373 (1926).—The splitting of glycylglycine with 0.2 N HCl is a typical bimol reaction (*C. A.* 17, 1573). 0.05 N glycylglycine in 0.2 N NaOH at 100° is decomposed in 7 hrs. Five-cc samples were taken in certain intervals; they were neutralized with 0.2 N HCl (phenolphthalein as indicator) and further titrated by Sørensen's method. The results were: (time (hrs) t , $\frac{1}{t}$ broken up x , $K = 1/t \cdot \log(a - x)$). 0, 44.0, 0.25181; 1, 60.0, 0.19897; 2, 76.0, 0.20660; 3, 100.00, —. Changing the concn. of glycylglycine to 0.1 N, other conditions the same, the splitting was slower for the same period of time but faster than with acid. A. A. B.

The rate of racemization of pinene, a first-order homogeneous gas reaction. D. I. SMITH. *J. Am. Chem. Soc.* 49, 4350 (1927).—The rate of racemization of (*d*) pinene was measured in soln. in the gas phase and as the pure liquid over the range 184–237°. The rate of racemization is only 50% larger in the pure liquid than the dil. gas, is independent of surface, and pressure. The heat of activation is 43710 cal., in approx. agreement with the Dushman equation. F. R. B.

Mechanical models of the kinetics of chemical processes. G. PROKOPOVICH. *Ukrainskii Khim. Zhurnal* 2, 81–104; *Chem. Zentr.* 1926, II, 2373.—Balls are drawn from an urn. The white ones are put back, the black ones are replaced by white ones. If the no. of black balls in the urn was A and if α balls were withdrawn per unit of time, then the velocity const. of the monomol. reaction is proportional to α/A . Similar model for reactions of a higher order are described. C. C. DAVIS

The reaction of the formation of barium sulfate. V. GUREVICH. *Ukrainskii Khim. Zhurnal* 1, 585–94 (1925); *Chem. Zentr.* 1926, II, 1556.—When dil. solns. contg. Ba^{++} and SO_4^{--} , resp., are allowed to flow together, turbidity as manifest by the Tyndall effect does not appear immediately, but only after a latent period t , which is measurable (Winkler, *Z. anorg. Chem.* 33, 311). Addn. of HCl, NH_4Cl , KCl, MgCl_2 or FeCl_3 increases t , for equimol. concns. Fe^{+++} having a greater retardant effect than Mg^{++} . The latter has the same effect as H^+ , which has a greater effect than K^+ or NH_4^+ , which are similar in effect. With 0.000187 mol. K_2SO_4 and 0.102 mol. BaCl_2 per l. t , 0. With the addn. of 0.652 mol. of HCl t becomes 23 sec., with 2.00 mol. HCl 5 min., with 1.304 mol. KCl, 12 sec.; with 1.304 mol. NH_4Cl , 17 sec.; with 0.75 mol. FeCl_3 , 25 sec.; with 2.055 mol. MgCl_2 , 4.5 min.; and with 0.172 mol. FeCl_3 , 23 sec. The concn. of glycerol does not alter t . Crystn. from a supersatd. soln. or coagulation of a colloidal sol should be accelerated by electrolytes, so that the increase in t must be due to other phenomenon. It is regarded by G. as an example of the Brønsted law (*Chem. Zentr.* 102, 169) according to which reactions between ions of opposite charge are retarded by neutral salts. A quant. comparison with the theory is impossible because the activities of the concd. solns. used are not known. C. C. DAVIS

Equilibria in the reduction, oxidation and carburization of iron. II. Methane-hydrogen equilibria in the presence of cobalt. RUDOLF SCHENCK, F. KRÄGELOH AND FRIEDRICH STÜCKEN. *Z. anorg. allgem. Chem.* 164, 313–25 (1927).—The authors wish to know whether the equil. conditions resulting from the action of Co upon CO are solely those due to the reaction: (I) $2\text{CO} \rightleftharpoons \text{C} + \text{CO}_2$, or whether other equilibria involving a Co carbide must also be considered. The results of an incomplete series of experiments performed in 1914, are given. At that time Co was considered to act solely as a catalyst in the reaction mentioned above and no carbide equilibria were thought to be involved. Doubt in the matter has led the authors to det. the equil. conditions in the closely related system: $\text{CH}_4 \rightleftharpoons \text{C} + 2\text{H}_2$, catalyzed by Co. The procedure is the same as that used in the system $\text{Fe}-\text{CH}_4$ (cf. *C. A.* 21, 3334). The primary reaction is a catalytic decompn. of the CO according to (I). Co is a better catalyst for this reaction than Fe. Superimposed upon this equil. is another involving Co carbide. This equil. is reached more slowly than the former. Both equilibria are studied quantitatively over the range 310–740°. Above 680° the reaction involving the carbide is no longer encountered. Although Co carbide was not isolated, its properties are predicted. The parallelism between the effects of Fe_3C and Co carbide on the decompn. of CH_4 leads the authors to believe that, as with Fe, it is likely that Co carbide forms mixed crystals with Co. The heat of formation of Co carbide is found by calcn. to be –11,300 cal. The authors draw the following conclusions with regard to the influence of Co upon equil. (I): above 668° the influence is purely catalytic;

below this temp. it is difficult to explain the equil. relations unless the existence of dil. mixed crystals of Co carbide in Co is postulated.

The problem of clean platinum electrodes in the determination of the electric conductivity of electrolytes. A. GERASIMOV. *J. Russ. Phys.-Chem. Soc.* **58**, 196-200; *Chem. Zentr.* 1926, II, 2326.—To test the applicability of clean electrodes for cond. measurements, the resistance capacity C of a cond. cell having clean electrodes was detd. as a function of the concn. of the soln. (KCl or $MgSO_4$) and of the apparent resistance. The results show that C increases with decrease in the resistance of the soln., even within the range where the min. was sharp and where the electrode surfaces satisfied the Kohlrausch conditions. The relative change in C from 0.001 N to 0.01 N KCl was 1.9%, and that from 0.001 N to 0.02 N $MgSO_4$ was 2%. If R is the apparent resistance of the cell, formulas such as, $C = a + b/R$, or $C = a - bR$, where a and b are consts., conform to the exptl. data.

C. C. DAVIS

Reversal of chemical reactions by electrolysis. ROBERT SAXON. *Chem. News* **133**, 342(1926).—The reversal of electrolysis of common reactions of pptn. such as that of $CaCl_2$ and Na_2SO_4 is discussed. Conclusion: The elec. current does reverse chem. reactions of this type. The yields in percent in a few common reactions are given.

WILLIAM J. SWEENEY

The oxidation of cacodyl oxide. AMAND VALEUR AND PAUL GAILLIOT. *Compt. rend.* **185**, 70-1(1927).—A slow current of air is passed into cacodyl oxide (I) under a layer of water at room temp. The O_2 absorbed is equiv. to only 50% transformation of I into cacodylic acid. The remainder of I is converted, without the intervention of O_2 , into $(CH_3)_3As$, CH_3AsO and As_2O_3 . The decompn. of I into the last 3 compds. is caused by the catalytic action of a peroxide. The foregoing transformations constitute a new kind of catalyst due to peroxide—one in which synthesis and retrogradation occur simultaneously.

FREDERICK C. HAHN

Dissociation pressure of sodium sulfate decahydrate. II. MOTOTARO MATSUI, SHINOSUKE FUKUSHIMA AND SUKEO NAKADA. *J. Soc. Chem. Ind. (Japan)* **30**, 330 41(1927); cf. *C. A.* **20**, 3261.—The vapor pressure of $Na_2SO_4 \cdot 10H_2O$ was measured with an improved form of the static isotenoscope. Sixteen values were obtained at so many different temps., kept within ± 0.01 - 0.05° , in the range of 20-50°. These values were fairly concordant with those obtained by Wuite (*C. A.* **8**, 1224) statically, but lower than those obtained by other authors dynamically. From the above data, the following vapor pressure equations were derived: $\log p = -2837.83/T + 10.7866$ below 32.4°; and $\log p = -2360.58/T + 9.2254$ above 32.4°. The transition point was computed from the equation to be at 32.6°.

SHUMPEI OKA

The dissociation of some organic and inorganic substances at high temperatures. GLADYS M. WOOD AND T. C. POULTER. *Proc. Iowa Acad. Sci.* **33**, 172-3(1926).—The investigation was undertaken to ascertain whether the well-known cond. in many gaseous reactions at high temps. is due entirely to the reaction or partially to the disassocn. of one or the other or both of the constituents into charged particles. For the exptl. work, a tube 150 mm. long and 15 mm. in diam. contg. one Pt and one W electrode was used. The electrodes were of wire; they overlapped about 22 mm. and were about 3 mm. apart. This tube was heated to approx. 500°. A gentle stream of vapor of the following substances was passed through the tube at atm. pressure. A potential of from 1 to 15 v. was applied to the electrodes and the current was read by means of a galvanometer. The following substances showed a deflection ranging from 1 to 15 scale divisions: glacial $AcOH$, Et acetoacetate, HCl , $AmOH$, I , $C_6H_5NO_2$. Those showing a deflection of less than one scale division are 75% $AcOH$, amylene, CCl_4 , C_6H_5Cl , HCO_2H , Br , $PhBr$, $AcOMe$. Those showing no deflection are C_6H_6 , $MeOH$, NH_3 , toluene, $CHCl_3$, H_2O , Et alc., C_6H_5CHO , $EtBr$, air.

W. G. GAESSLER

Studies in metallic nitrides and hydrides. I. I. ZHUKOV. *Ann. inst. anal. phys. chim.* **3**, 14-41(1926).—A no. of metals were heated to 1250° in the presence of N_2 . The absorption of gas by Mg begins at 780-800°, a product of the compn. Mg_3N_2 being formed; Ca filings react at the same temps. to form Ca_3N_2 (solid at 1250°) while Li_3N results with Li. The above 3 compds. show no measurable dissocn. pressure below 1250°. Pressures of varying amts. of N_2 in contact with Mn and Cr were recorded. The isotherms (910 and 1175 for Mn, 1100 and 1200 for Cr) represented equilibria with a solid phase of continuously varying compn. Al begins to form AlN between 850° and 875°. Pure Ti was not available; the specimen studied behaved in general like Mn or Cr. At 1000° Mo absorbed only 20 cc. N_2 per 5 g. of the metal. No reaction below 1250° was observed with V, W, Zn, Cu and Fe; 4 g. of U absorbed 27 cc. of the gas at 1000° (the sample used contained carbide as an impurity). In cond. measurements of the nitrides the powd. sample was compressed in an ivory cyl.

under between a steel piston and brass plate serving as the electrodes. The conductivities of the azotized Cr, Mn and Ti were of the order of that of the pure metals, while with AlN , Ca_3N_2 and Mg_3N_2 it was below 5×10^{-7} . Azotized Mn and Cr affect the magnetic needle; this property does not increase parallel with the N content.

BASIL C. SOYENKOFF

The metallic nitrides. I. I. ZHUKOV. *Ann. inst. anal. phys. chim.* 3, 461-2(1926); cf. preceding abstr.—Dissoen. pressures of NaH are 75 mm. at 360° and 261 mm. at 390° . CeH_2 has a pressure of 1 mm. at 450° and 490° and forms solid solus. with the excess of H_2 . Rh shows compd. formation with H_2 at 0° , 25° and 100° ; Ir forms only solid solus.

BASIL C. SOYENKOFF

The solubility curve of copper in aluminum. P. YA. SAL'DAU AND N. N. ANISIMOV. *Ann. inst. anal. phys. chim.* 3, 485(1926).—A satd. soln. of Cu in Al contains 2.7% between 150° and 300° , the concn. increasing rapidly with the temp. to 5.6% at 500° . The hardness of alloys tempered at 500° reaches a max. at 6% Cu; the max. of aging also lies at 6%.

BASIL C. SOYENKOFF

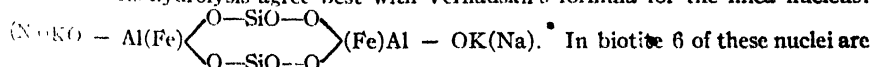
The chemical structure of the natural hydrates of ferric oxide. N. S. KURNAKOV AND R. YA. RODE. *Ann. inst. anal. phys. chim.* 3, 305-32(1926).—The only possible hydrate of definite compn. is $\text{Fe}_2\text{O}_3 \cdot \text{H}_2\text{O}$ (hetite and lepidocrocite). (1) Hydrohematites are solid solus. of H_2O in hematite; their heating and dehydration curves are continuous. The max. H_2O content was 7.98%. (2) Hetites, lepidocrocites, limonites and brown ores contain 9.9 to 13.2% H_2O , 10.1% combined to form the monohydrate and the rest dissolved in the latter. The heating curves, besides the hetite break, show an inflection at $125-35^\circ$ where the solid soln. begins to decompose. The dehydration curves show a break at $200-50^\circ$ where hetite passes into solid soln. of H_2O in hematite. (3) Xanthosiderites, lake ores, pea ores, limonites contg. 13.8% and more of H_2O have heating curves discontinuous at $120-50^\circ$ besides the usual hetite break. A transition from xanthosiderite to hetite solid soln. probably occurs at this point. Lake ores exhibit recalcence at $325-400^\circ$, probably due to their finely dispersed state; specimens belonging to older formations do not show this effect.

B. C. S.

Heating of formate solutions under pressure. HANS TROPSCH AND A. V. PHILIPPOVICH. *Abhandl. Kenntnis Kohle* 7, 103-6(1925); *Chem. Zentr.* 1926, II, 1401.—Though at 175° formates of the alkalis and alk. earths are resistant to heating under pressure, expts. show that when heated to $340-400^\circ$ aq. HCO_2Na decomps. to Na_2CO_3 and H_2 , and that the reaction is reversible. $(\text{HCO}_2)_2\text{Ca}$ decomps. otherwise, possibly on account of first forming CaCO_3 and HCHO and the HCHO then decompg. into CO and H_2 . This would explain the formation of a large proportion of CO in the pressure heating.

C. C. DAVIS

The action of dilute acid and soda solution on mica. A. FIOLETOVA. *Ann. inst. anal. phys. chim.* 3, 426-33(1926).—Specimens of biotite were wholly decomd. by 1% HCl within 10 hrs. while 2% HCl attacked less than half of the total wt. Ignition to $500-550^\circ$ hinders the subsequent action of acid. The av. compn. is 36.72% SiO_2 , 1.05% TiO_2 , 13.84% Al_2O_3 , 7.32% Fe_2O_3 , 15.53% FeO , 0.48% CaO , 3.18% MgO , 10.56% K_2O , 4.45% Na_2O and 5.57% H_2O . The high H_2O content of mica and the products of its hydrolysis agree best with Vernadskii's formula for the mica nucleus:



ed with 5 addnl. groups $\text{HO}(\text{Fe})\text{MgO}(\text{OH})\text{Si}(\text{O})_2$.

BASIL C. SOYENKOFF

The equilibrium between hydrates of calcium sulfate. D. BALAREFF. *Z. anorg. Chem.* 163, 137-40(1927).—Dehydration of $\text{CaSO}_4 \cdot 0.5\text{H}_2\text{O}$ is reversible above

80° . The system is univariant. Below 80° the vapor pressure falls below 2 mm. A transformation takes place at 82° from one anhydride to another.

R. H. L.

The fusibility of the mixtures of lithium and magnesium fluorides. V. P. IL'INSKIY AND P. F. ANTIPIN. *Ann. inst. anal. phys. chim.* 3, 464(1926).—The eutectic lies at 718° , solid solus. being formed on the LiF side.

BASIL C. SOYENKOFF

Melting points of the ternary system sulfuric acid-acetic acid-water. ALEXANDER LEFFMAN. *Trans. Am. Inst. Chem. Eng.* 18, 187-94(1926).—M. ps. of a no. of H_2SO_4 - AcOH - H_2O mixts. were obtained by starting with a given mixt. of the concd. acids and detg. the m. ps. after the addn. of known successive amts. of H_2O , the final dil. soln. being analyzed to det. the amts. of the resp. acids. With these data the ternary diagram was mapped. Mixts. of H_2SO_4 and AcOH do not form a binary system but are part of the ternary system SO_3 - $(\text{CH}_3\text{CO})_2\text{O}$ - H_2O . H_2SO_4 dehydrates AcOH even in the presence of enough H_2O to form $\text{H}_2\text{SO}_4 \cdot \text{H}_2\text{O}$. No compd. of H_2SO_4 and AcOH with or without H_2O was found, although Kendall describes one with a m. p. of -2.5° .

The possibility of the existence of such a compd. was not disproved, for the viscosity of the soln. is so high as to make crystal. processes very slow. A. W. KENNEY

The ternary system silver-tin-copper. W. GUERTLER AND W. BONSAK. *Z. anorg. allgem. Chem.* **162**, 22-30 (1927).—In the binary system Ag-Sn, Ag_3Sn crystallizes out at 480° . The compd. $\text{Ag}_{15}\text{Sn}_3$ has also been identified. In the system Cu-Sn the most marked crystal type is Cu_5Sn , while in the system Ag-Cu no intermediate crystal type exists. In the ternary system a wide range of compn. is studied, from 90% Ag, 3% Sn and 7% Cu to 10% Ag, 39% Sn and 51% Cu, and the equil. diagram is discussed. The Ag mixed crystal zone is the most important part of the system technically, as an alloy which lies in this zone greatly resembles Ag in color and resistance to attack, while the mech. properties are improved by addition of the other metals. No. 1 alloy, contg. 86% Ag, 6% Sn, 8% Cu shows a Brinell hardness of 63.5, No. 4 contg. 84% Ag, 8% Sn and 8% Cu shows for Brinell hardness 70.8 and No. 8 contg. 75% Ag, 17% Sn, 8% Cu gives Brinell hardness 65.3. Nos. 1 and 4 are in the heterogeneous zone of Ag and Cu_5Sn mixed crystals; No. 8 is in the heterogeneous zone of Ag-Cu-Sn. Hardness increases as Ag_3Sn_2 is approached. H. STOERTZ

The transformations of the system tin-cadmium in the crystalline state. A. FEDOROV. *Ukrainski Khim Zhurnal* **2**, 69-71; *Chem. Zentr.* **1926**, 11, 2405.—The thermal diagram of state of the system Sn-Cd was investigated and is shown. It gives no evidence of the formation of a compd. The eutectic point is at 177° and corresponds to 70% Sn by wt. The eutectic can be followed from 0 to about 90% Sn. At lower temps. the solv. of Cd in Sn reaches 24%. On cooling below 120° , the solid soln. decomp. into β -Sn and Cd. The thermal effect of the transformation shows a max. for various compns. of the fusion mixt. which depends upon the cooling conditions. C. C. DAVIS

Equilibria in the system gold-zinc. P. YA. SAL'DAU. *Ann. inst. anal. phys. chim.* **3**, 211 (1926).—Cond. of Au-Zn alloys was measured over a wide range of temps. and compn. with the aid of a special app. (cf. C. A. **11**, 1626). Cooling curves of the alloys were detd. as well as the microstructure. Au-Zn seps below 420° from the solid phase α (contg. 25% Zn) as α_1 , which undergoes a transformation at about 270° into α_2 stable at low temps. All cond. isotherms show a max. at 1:1 (Au:Zn). Cond. data and microstructure do not confirm the existence of compd. AuZn_3 found by Vogel. A solid phase contg. 75% Zn forms AuZn_3 at about 500° ; another modification of this compd. appears on cooling to 250° . Conductometric analysis, in general, serves to distinguish 3 types of solid phases of variable compn., phases formed by the free components of the system whose cond. isotherms do not exhibit maxima, phases, characterized by maxima located at all temps. at the same ordinates, contain undissoc. compds. plus their components, phases, whose cond. maxima shift with temp. and on cooling approach ordinates corresponding to the rational compn. of compds., contain partly dissoc. compds. BASIL C. SOYENKOFF

The methods of determining the composition of the solid phase in systems at equilibrium. B. P. SHISHOKIN. *Ann. inst. anal. phys. chim.* **3**, 421-5 (1926).—Schreiner's method (*Z. physik. chem.* **11**, 81 (1893)) is more exact when the compn. of the liquid phase and residue is expressed in g. per 100 g. of the solvent. Then for the angle of intersection $\lg \alpha = (a_2 - a_1)/(b_2 - b_1)$, where a and b are the concns. of A and B in the liquid and a_2 and b_2 in the residue, resp., provided the solid phase contains no water of hydration. When applied to the system AgNO_3 -guanidine nitrate $\cdot \text{H}_2\text{O}$ the method proves the existence of $2\text{AgNO}_3 \cdot \text{CH}_3\text{N}_3 \cdot \text{HNO}_3$. Rivett and Clendinning's data (C. A. **17**, 3292) show the formation of solid solns. on either side of $2\text{NH}_4\text{Cl} \cdot \text{CuCl}_2 \cdot 2\text{H}_2\text{O}$. BASIL C. SOYENKOFF

The analytical and graphical methods of study of the equilibria of complex systems. V. P. SHISHOKIN. *Ann. inst. anal. phys. chim.* **3**, 333-69 (1926).—Matzestinsk and Agursk springs are formed by the mixt. of metamorphosed Black Sea water and a component poorer in mineral salts. The main mineral springs of Pyatigorsk are also a mixt.; the waters of southern Mashuk and radioactive waters are derived from the main springs. Penfield-Foote formula for tourmalines satisfies their characteristic equation. BASIL C. SOYENKOFF

The equilibria of tetranitromethylaniline in certain binary systems. N. N. EFREMOV AND A. M. TIKHOMIROVA. *Ann. inst. anal. phys. chim.* **3**, 289-301 (1926).—Tetryl m. 126.8° ; crystals reappear at the m. p. only upon inoculation and stirring. With $o\text{-NO}_2(\text{OH})\text{C}_6\text{H}_4$, m. 44.9° , a eutectic was found at 40.2° and 12.2% of tetryl; solid solns. are formed contg. up to 5.5% of the phenol. The liquid mixts. are mobile, bright yellow and do not tar on superheating. $p\text{-NO}_2(\text{OH})\text{C}_6\text{H}_4$, m. 113.8° , forms viscous mixts. which darken on heating. The eutectic lies at 80.6° and 50.6% of the

phenol. Solid $p\text{-NO}_2(\text{OH})\text{C}_6\text{H}_4$ dissolves up to 10.5 mols. of tetryl. $p\text{-NO}_2(\text{Me})\text{C}_6\text{H}_4$, m. 52.4, exhibited a eutectic at 46.6° and 23.4% of tetryl; the mixts. were stable, colorless and crystd. rapidly. No solid solns. were formed. With $o\text{-NO}_2(\text{NH}_2)\text{C}_6\text{H}_4$, m. 69.4°, a eutectic results at 49.7° and 73.2% of the amine; the liquid mixts. decomposed at 115–50°; no solid solns. were formed. Tetryl and $m\text{-NO}_2(\text{NH}_2)\text{C}_6\text{H}_4$, m. 114.0°, gave a eutectic at 78.3° and 55.3% of the aniline; the mixts. are unstable, solid solns. are not formed. $p\text{-NO}_2(\text{NH}_2)\text{C}_6\text{H}_4$, m. 147.3°, has a eutectic at 87.2° and 40.6%; the mixts. are unstable. $m\text{-(NO}_2)_2\text{C}_6\text{H}_4$, m. 69.5°, showed a eutectic at 65.5° and 66.5%; the components do not form solid solns. 2,4-(NO_2)₂ C_6H_3 forms a eutectic mixt. with tetryl which m. 59.1° and contains 20.5% of the latter. Liquid solns. are fairly stable, solid solns. do not exist. With 2,4-dinitrophenol m. 111.4° a eutectic was obtained at 83.1° and 57.7%. Solid solns. begin at 16% of tetryl and 18.5% of the phenol. Picric acid m. 122.4°, forms vitreous mixts.; the eutectic lies at about 75–7° and 43% of the phenol. The liquid mixts. can be heated above their m. p. without decompn. The eutectic with strychnic acid, m. 175.5°, is located at roughly 25.5% of the acid and 81.1°. The mixts. give off oxides of N on heating to the m. p. and gelate on cooling. 2,4,6-Trinitrophenol m. 78.8°, forms a eutectic at 58.8° and 63.4%. Crystn. proceeds with great difficulty. No evidence was found for the existence of the 3:2 compd. discovered by Gmra. The eutectic mixt. of 2,4,6-trinitrocresol (m. 101.2°) contains 36–7% of tetryl and m. about 78°. The ratios of the components in the above-mentioned eutectic mixts. approach those of small whole nos. Solns. of tetryl in picric acid and TNT are in most suitable for military purposes.

BASIL C. SOYENKOFF

A thermoanalytical study of the formation of naphthylamines from naphthols. B. N. MENSHUTKIN AND N. A. BUTKOV. *Ann. inst. anal. phys. chim.* 3, 405–20 (1926). Solv. curves of the system $\text{ZnBr}_2\text{PhNH}_2$ show a max. at 270° and about 55% of ZnBr_2 , corresponding to $\text{ZnBr}_2\cdot 2\text{PhNH}_2$; a eutectic of the compd. and ZnBr_2 lies at 17° and 81.6°, while with PhNH_2 it is too close to the m. p. of the latter to be detd. $\text{ZnBr}_2\cdot 2\text{MeHNPh}$ is insol. in the free amine, easily sol. in EtOH and Et_2O , decomps. without m. 285°. $\text{ZnBr}_2\cdot 2\text{Me}_2\text{NPh}$ is similarly insol. in Me_2NPh , hardly sol. in EtOH and decomposes without melting at 280°. ZnBr_2 and α -naphthylamine form $\text{ZnBr}_2\cdot 10\alpha\text{NH}$, m. 241°; the eutectics lie at about 225° and 47°, and 35 and 0.5% of ZnBr_2 , m. p. The mixts. are viscous and crystallize very slowly. $\text{ZnBr}_2\cdot 2\beta\text{-C}_{10}\text{H}_7\text{NH}_2$, m. 261°; its eutectic with ZnBr_2 is at about 200° and 60% ZnBr_2 while the eutectic of the amine lies close to its m. p. $\text{ZnCl}_2\cdot 4\alpha\text{-C}_{10}\text{H}_7\text{NH}_2$, m. 253° and forms a eutectic with ZnCl_2 at 65° of the latter and 220°, with the amine at 47° and about 0.1% ZnCl_2 . $\text{ZnCl}_2\cdot 2\beta\text{-C}_{10}\text{H}_7\text{NH}_2$, m. 270°; the first eutectic is at 205° and 62% ZnCl_2 , the second close to the m. p. of the amine. The data on β -naphthol- β -naphthylamine agree with those of Kremann and Strohschneider, a slight difference being due to the higher m. ps. of the amine used by the above authors (*C. A.* 13, 2475). ZnCl_2 and ZnBr_2 are insol. in naphthols and phenols. CaCl_2 forms no compds. with naphthols nor with naphthylamines. CaCl_2 is a better catalyst for the reaction between naphthols and NH_3 since it does not form mol. compds. with the resulting amines like ZnCl_2 and ZnBr_2 . The reaction $\beta\text{-C}_{10}\text{H}_7\text{OH} \rightarrow \beta\text{-C}_{10}\text{H}_7\text{NH}_2$ is not complete on account of the formation of $2\beta\text{-C}_{10}\text{H}_7\text{OH} \cdot \beta\text{-C}_{10}\text{H}_7\text{NH}_2$, which must be decompd by alkali.

BASIL C. SOYENKOFF

The singular isotherms of solubility of naphthalene in mixtures of aniline and allyl mustard oil. N. I. STEPANOV AND S. V. LIPIN. *Ann. inst. anal. phys. chim.* 3, 409–26 (1926). On a triangular diagram the isotherms appear as nearly straight lines meeting at a sharp angle; the point of intersection lies on the bisector 50% PhNH_2 –50% $\text{H}_2\text{NCH}_2\text{CH}_2\text{NCS}$. The substituted thiourea forms a dimer in the liquid state.

BASIL C. SOYENKOFF

Electrical conductivity of binary liquid systems. S. I. CHERBOV. *Ann. inst. phys. chim.* 3, 459–60 (1926).—A study of the mixts. of PhNH_2 and AcOH confirms the results obtained by Konovalev (*J. Russ. Phys.-Chem. Soc.* 24, 440). The isotherm (at 17°) for $\text{Ac}_2\text{O}\text{--H}_2\text{O}$ resembles the viscosity isotherm except that the point is located at 96% mol. H_2O .

BASIL C. SOYENKOFF

Equilibria in systems with phases separated by a semi-permeable membrane. XXII. P. A. H. SCHREINEMAKERS. *Verslag Akad. Wetenschappen Amsterdam* 36, 139–40 (1927); cf. *C. A.* 21, 3010.—A mathematical derivation, showing that the permeability of a double membrane is affected by temp.

C. CALINGAERT

Theory of acid and basic catalysis. The mutarotation of glucose. J. N. BRÖN-DELAND AND E. A. GUUGENHEIM. *J. Am. Chem. Soc.* 49, 2554–84 (1927).—In correspondence with an extended conception of acids and bases, a new theory of acid and basic catalysis is presented, in which the catalytic effect is ascribed, not particularly to the H^+ and HO^- ions, but to the action of acid and basic mols. in general. Previous work

in the field is discussed and criticized. The mutarotation reaction of glucose has been studied by a dilatometric method under the influence of a no. of acids and bases of various electric charge types. The results of the expts. have given strong support to the theory presented. The catalytic effect of acid and basic mols. on the mutarotation of glucose increases with their strength as acids and bases. There seems to be a simple relationship between catalytic efficiency and strength, shown by the fact that a log. plot of the basic catalytic const. against the basis strength constant, covering the range of 10^{18} in the latter, is approx. a straight line with slope of about 0.4. The laws of mutarotation are in marked conformity with the laws previously found for the decompn. of nitramide.

C. J. WEST

Methanol catalysts. I. H. S. TAYLOR AND G. B. KISTIAKOWSKY. *J. Am. Chem. Soc.* **49**, 2468-76(1927).—Adsorptions of H, CO and CO₂ on 2 methanol catalysts, ZnO and ZnO-Cr₂O₃, were measured at 0° and 100°. In order to obtain reproducible results it was necessary to clean the surface of H₂O and CO₂ by preliminary evacuation at 400°. Both these catalysts had adsorptive capacities considerably greater than those of most metal catalysts. The adsorption of both H and CO is large at very low pressures and rapidly reaches satn. capacity independently of further pressure increase. The expts. indicate that the heat of adsorption is of the same order as that on metal catalysts. The mixed oxide catalyst shows greater adsorptive capacity than the ZnO. The results are consistent with the known facts concerning methanol synthesis on these catalysts.

R. L. DODGE

The catalytic synthesis of water vapor in contact with metallic gold. A. F. BENTON AND J. C. ELGIN. *J. Am. Chem. Soc.* **49**, 2426-38(1927); cf. *C. A.* **21**, 691.—The catalytic formation of H₂O from H and O in the presence of a reduced Au catalyst was studied in the temp. range 130-150°. The dynamic method was used. Adsorption of the 2 gases by Au was also measured by a static method. The rate of reaction varies as the square of the H pressure and the first power of the O pressure. It is approx. inversely proportional to the pressure of H₂O vapor. Preliminary treatment of the catalyst with O produced a large but transitory increase in yield. At 130-150° H is not adsorbed by Au in measurable quantities. O is strongly adsorbed; the amt. adsorbed increases with increasing temp., but is independent of the pressure. The adsorption rate is very low, is independent of the gas pressure, and increases with increasing temp. The kinetics of H-O combination over Ag and Au show little in common. No simple mechanism for the reaction in contact with Au is adequate to account for the observed results.

R. L. DODGE

Activity and temperature relationships for nickel catalysts. I. FRITZ THOREN. *Z. anorg. allgem. Chem.* **163**, 367-95(1927).—The activities of Ni catalysts prepd. in various ways were measured by a static method. The reactions used were: C₂H₄ + H₂ → C₂H₆; C₂H₄ + 3H₂ → C₂H₁₂; O₂ + 2H₂ → 2H₂O. The activity of the catalysts increased stepwise with increase in temp. The mean values for the temps. at which marked increase in activity was evidenced were 9.7°, 40.1°, 60.2°, 80.7°, 100.3°, 119.4°, 134.7°, 170.0°. The actual percentage increase in activity at the various activation temps. was not reproducible. The activation temps. were closely the same for all reactions, and for different Ni catalysts. The activation of the H is considered to be the cause of the phenomenon. II. *Ibid* **165**, 171-91(1927).—Previously reported expts. on the hydration of C₂H₄, C₂H₆ and O, using the static method, indicated a stepwise increase in activity of Ni catalysts with increase in temp. Further expts. on the hydration of C₂H₄, using the dynamic method and a single catalyst, confirmed the earlier results. The average temps. at which the irregular increases in activity occurred, appeared to be -18°, 10°, 41°, 61°, 81°, 100°, 120°, 139° and 163°. The results were not reproducible with different samples of the same catalyst.

R. L. DODGE

Ternary systems. VI. Sodium carbonate, sodium bicarbonate and water. A. E. HILL AND L. R. BACON. *J. Am. Chem. Soc.* **49**, 2487-95(1927); cf. *C. A.* **21**, 1915.—Isotherms of the system: Na₂CO₃-NaHCO₃-H₂O at 25°, 30° and 50° were studied. The double salt trona, NaHCO₃·Na₂CO₃·2H₂O, is stable in contact with satd. solns. from 21.26°, the temp. of its formation, up to at least 50°. The range of concns. within which it may be prepd. increases gradually with increase in temp. The salt is a stable phase from solns. contg. as little as 0.16% of NaHCO₃ at 31.98° and at no point requires for its formation more than 3.74% of NaHCO₃ in the soln. Four invariant temps. for the ternary system were found between the temp. of the ternary eutectic at -3.32° and 35.27°.

LOUISE KELLY

Diagrams of state of the systems silver nitrate-lithium nitrate and silver nitrate-rubidium nitrate. A. P. PALKIN. *J. Russ. Phys.-Chem. Soc.* **58**, 1334-8(1926).—Temps. were measured with the registering app. of N. S. Kurnakov. A Au-Pt thermo-

couple 0.15 mm. in diam. was inserted into a narrow capillary and the contents of the app. were stirred until the substance began to solidify. The melting-point curves were plotted based on the cooling curves of the melts. The melting was carried out in a test tube inserted in another tube of larger size. This app. was immersed in an oil bath at 170–180°. Other data were plotted based mainly on heating curves in the oil bath. In the system AgNO_3 - LiNO_3 , AgNO_3 , mp. 208°, undergoes polymorphous conversion at 159°; LiNO_3 , m. 245°. There is a eutectic pt. in this system at 75% AgNO_3 and 171.5°. Polymorphous conversion of AgNO_3 (159°) was observed from 100 to 33.5% of AgNO_3 . All fusions are colorless and very hygroscopic. Polymorphous conversion of AgNO_3 increases the vol., breaking the test tubes. RbNO_3 , m. 306°, colorless crystals of hexagonal system. In the system AgNO_3 - RbNO_3 2 eutectic pts. were observed, at 67.5% AgNO_3 and 128° and at 40% AgNO_3 and 136°. The "liquid" curve has a max. at 50%, 139.5°; at 37.5% AgNO_3 , 141° the curve shows a distinct bend, going up further up to the m. p. of RbNO_3 = 306°. The max. at 50%, 139.5° leads to the conclusion that the compd. $\text{AgNO}_3 \cdot \text{RbNO}_3$ is present. As the bend on the "liquid" curve corresponding to 141° is also seen on the other fusions up to 5% AgNO_3 and the eutectic pt. corresponds to 40% AgNO_3 , 136°, is traced to 25% AgNO_3 a second compd. of the compn. $\text{AgNO}_3 \cdot 3\text{RbNO}_3$ is thought to exist, corresponding to the ordinate at 25% AgNO_3 . All fusions are colorless and not hygroscopic. $\text{AgNO}_3 \cdot \text{RbNO}_3$, m. 139.5°, forms with AgNO_3 an ordinary type of binary fusion with 1 eutectic pt. at 128°. No solid solns. are formed. Polymorphous conversion of AgNO_3 - RbNO_3 was not observed in the heating curve. In the system AgNO_3 - RbNO_3 - RbNO_3 the ordinate shows an unstable compd. contg. 25% AgNO_3 ; it is decompd. above 141°. Polymorphous conversion of RbNO_3 occurs at 162°. The eutectic point corresponding to 141° is traced down to 5% AgNO_3 . The character of the system of metal nitrates of the first group, even series in Mendelyev's Periodic System is complicated with increase in at. wt.

A. A. BOEHLINGK

Electrolytic crystallization processes. I. V. KOHLSCHÜTTER. *Z. Electrochem. angew. physik. Chem.* **33**, 272-7 (1927).—A theoretical discussion of the mechanism of electrolytic crystn. of metals. Nearly every metal has its peculiar form of cathode deposit, which depends upon the electrochem. conditions and properties of the soln. from which sepn. takes place. As shown by the Röntgen spectroscope, the formation of the deposit may be regarded as a process of crystal formation, the discharge of the ions and the forming of the crystals being regarded by Blum and Rawdon as occurring simultaneously. This view is analyzed. Electrolytic crystn. is a case of topochem. reaction, in the field of force of cryst. matter. The combined cryst. growth, nucleus formation, direction of growth and the depositing of new individuals are chem. phenomena. A relation between the cathode potential and the form of deposit exists, but this is only one of the factors in the mechanism of deposition. **II. The aggregation forms of loose metallic deposits.** V. KOHLSCHÜTTER AND A. GOOD. *Ibid.* 277-89.—Metals which deposit on the cathode as loosely adhering needles or plates are studied. The method and app. used are, essentially, those of Kohlschütter and Uebersax (*C. A.* **18**, 1911). Pb is deposited from $\text{Pb}(\text{NO}_3)_2$ solns., Cd from CdSO_4 (neutral and ammoniacal), Zn from ZnSO_4 (neutral, ammoniacal and acid), Sn from SnCl_2 and SnSO_4 (acid, neutral and ammoniacal), Ag from AgNO_3 (neutral and ammoniacal) and Tl from Tl_2SO_4 and TlNO_3 (neutral and acid). The effect on the cryst. formation of varying temps. and concns. and c. d.s., using point and concn. electrodes, is studied. A comparison of the deposits shows that each metal has its own peculiar cryst. growth, depending upon the conditions under which the deposit is formed. Irregular aggregation forms are not infrequently observed, but to the forces on the crystal and in the electrolyte. Thus, Cd crystallizes with less ease than does Pb, while Zn behaves very similarly to Cd. Sn and Tl show great facility in crystallizing, the velocity of growth of the crystals being very rapid. Complex formation, in ammoniacal soln., furthers crystal development. Orientated position of nuclei goes hand in hand with crystg. ability. **III. The formation and properties of adherent metallic layers.** V. KOHLSCHÜTTER AND F. JAKOBER. *Ibid.* 290-308.—The method used for studying adherent metallic cathode deposits is similar to Kohlschütter and Vuilleumier's (*C. A.* **13**, 1050). The contractometer has the flexible cathode dipping horizontally, rather than vertically, into the electrolyte. Solns. of NiCl_2 -boric acid, NiCl_2 - NH_4Cl , CoCl_2 -boric acid, CoCl_2 - NH_4Cl , CoCl_2 , CoSO_4 , FeSO_4 , PdCl_2 , AgCN contg. excess KCN, chrome alum (CrCl_3 and $\text{Cr}_2(\text{SO}_4)_3$ could not be used), ZnSO_4 and ZnCl_2 (acid and neutral), ZnSiF_6 , ZnSO_4 (ammoniacal), Zn dissolved in excess NaOH, and PbSiF_6 are used for depositing the resp. metals. The effect on the nature of the deposit and on the contraction of deposition on Ag and Cu (Ni, Co, Fe, Cr) and Pt(Pd), of varying c. d. (Ni, Co, Fe, Cr, Pd, Ag), thickness of

deposit (Ni, Co, Fe), superimposing a c on d e. (Co, Fe), compn. of electrolyte and acid concn. (Co, Fe, Cr), varying temp. (Co, Fe, Pd), depolarizers and H content on Pd deposits and varying KCN concn. on the Ag deposit is studied. For Ni, comparison of curves from the new type of contractometer with the old, shows the contraction to be more nearly proportional to the deposition. The contraction caused by Co deposits is less than that by Ni in all cases, that caused by Fe lying between the 2, under similar conditions. When the metal appears highly divided during deposition and the electrode is evenly covered, then contraction appears, as in the cases of Ni, Cr, Co, Fe and Pd. With Zn and Pb no contraction on deposition could be obtained in any of the solns., an expansion always taking place. J. BALOZIAN

Researches on the electrolysis of copper in the presence of gelatin. C. MARIN AND A. BUEFFAT. *J. chim. phys.* **24**, 170-81 (1927). Cu, deposited from soln. contg. gelatin, is fine-grained and has a luster. A heavier deposit is obtained from such a soln. than from a soln. of pure CuSO_4 of the same concn. The surcharge consists of 33% CuSO_4 and 66% gelatin and its compn. is independent of c d. A study of the amt. of surcharge S , compared to the gelatin concn. (of the soln.) C , shows the phenomena to be one of adsorption following the formula: $S = KC^{1/2}$. E. G. VANDENBOSCH

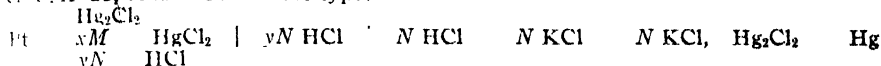
The persistence of potential at a mercury cathode on open circuit. F. P. BOWDEN, JR. *Trans. Faraday Soc.* **23**, 511-83 (1927). After prolonged electrolysis of dil. H_2SO_4 , the overpotential at a Hg cathode on opening the circuit persists for several hrs. This persistence must be due either to active H or to negative metal impurities. Exptl. evidence is advanced to show the latter is the case and the impurities are identified as Na, Mg, Al, Zn, Pb and As. The amt. of impurity necessary is very small, being less than 10^{-6} g. equivs. It is shown that the H-ion concn. in the vicinity of the cathode may be very different from that obtained in the bulk of the electrolyte and that this has an important influence on the rate of fall of the potential. So that even in apparently pure soln. the potential of a cathode on open circuit is controlled by traces of negative metal impurities on its surface. It is apparent that the measurement of these potentials can throw little light on the true H overpotential. Moreover, since the decay curves are not smooth, measurements of the back e. m. f. at set intervals after the circuit is opened and extrapolation to zero time may give a quite erroneous value for the potential at this instant. The presence of these impurities offers a satisfactory explanation of the "hydrides" observed at a Hg cathode. In general, in order that cathodic back e. m. fs. may be interpreted with confidence as H overpotential phenomena it is necessary to ensure that metallic impurities of the order of $< 10^{-6}$ g. equiv. have not been deposited on the cathode surface. Under most exptl. conditions impurities are present in amts. greater than this. This also offers a method complementary to that of Heyrovski (*C. A.* **18**, 2997) for the detection and identification of traces of impurities in soln. In a note added to the paper, A. L. MCAULAY describes 2 different sorts of expts. which made him reach the same conclusions totally independently of B. The first expt. consisted in passing the gases from a Hg cathode which showed a high and lasting overpotential over or through a Hg drop arranged by various devices in different pieces of app. to be as near as possible to the overpotential cathode. In no case did the Hg drop show any sign of acquiring an overpotential by activation by the gases. The second expt. had for its object an attempt to produce overpotential by bombarding Hg with monoatomic H. A discharge tube of Pyrex had as cathode about 1 cc of Hg. H at a few cm. pressure was passed through the tube, and on or through the Hg. In every case a heavy condensed discharge from an induction coil was passed through the tube, the red glow of the Balmer series coming well down on the Hg cathode. Great care was taken to keep the cathode cool. The app. was so arranged that immediately on stopping the discharge the tube was flooded with N H_2SO_4 and the Hg became automatically a half cell completed by a calomel electrode. Although the Hg had been bombarded by monoatomic H in large quantities for about 1 hr. it never became more negative than the calomel electrode. A. L. HENNE

The electrode potentials of beryllium, magnesium, calcium, strontium and barium from thermal data. W. M. LATIMER. *J. Phys. Chem.* **31**, 1267-9 (1927).—By using the expression, $E^\circ nF = \Delta F = \Delta H - T\Delta S$, where nF is the no. of faradays, ΔF the free energy, ΔH the heat of soln. of the metal in acids and ΔS the entropy change, values for the electrode potential, E° , of the following metals were calcd.: Be = -1.69 v.; Mg = -2.40 v.; Ca = -2.87 v.; Sr = -2.92 v.; Ba = -2.90 v. E. G. V. B.

The effect of hydrochloric acid on the electrode potential between mercury and mercurous chloride. S. R. CARTER, F. M. LEA AND R. A. ROBINSON. *J. Chem. Soc.* **1927**, 1906-11; cf. *C. A.* **21**, 1400.—Cells of the type: Hg | Hg_2Cl_2 , x N HCl | N HCl | N -KCl | N KCl, Hg_2Cl_2 | Hg were measured at 18° with solns. of HCl vary-

mg from 10.09 N ($E = 0.4102$ v.) to 0.0027 N ($E = 0.7035$ v.). The presence of HgCl_2 tends to decrease the Cl^- -ion concn., resulting in an increase in e. m. f., but this has only a small effect on the above values.

Oxidation-reduction potentials of mercurous and mercuric chlorides in hydrochloric acid solutions. S. R. CARTER AND R. A. ROBINSON. *J. Chem. Soc.* 1927, 1912-23; cf. *ibid.* 21, 1400—Cells of the type:



were studied at 18° with HCl varying from 0.01 to 10 N and HgCl_2 from 0.00013 to 0.5 N . The logarithm law holds with the more dil. solns. of HgCl_2 but breaks down when the concns. of HgCl_2 and HCl are of the same order, on account of the formation of complex ions such as HgCl_4^{--} . SO_2 causes the oxidation of Hg_2Cl_2 to HgCl_2 when in 8 N to 2 N acid; with 2 N to 0.16 N acid there is decompn. according to the equations: $\text{Hg}_2\text{Cl}_2 \rightarrow \text{Hg} + \text{HgCl}_2$; with 0.16 N to 0.07 N acid it is unaffected, with more dil. acid it is reduced to Hg . The oxidation potential of SO_2 in 0.18 N HCl is less than the oxidation potential of the Hg system when the concn. of the HgCl_2 is greater than 0.0094 M and greater when the concn. is less than 0.0094 M .

E. G. VANDEN BOSCHÉ

Experimental researches on non-polarizable electrodes. ANDRÉ STROHL AND FRÉDÉRIC PORTIS. *Ann. physiol. physicochim. biol.* 3, 61-88 (1927).

H. J. D., JR.

Removal of a common source of trouble in hydrogen-ion measurements. STEPHEN POLKOFF AND A. H. KUNZ. *Proc. Iowa Acad. Sci.* 33, 169 (1926).—The best conditions for platinum Pt black deposits are given. If these conditions are followed, it is rather difficult to "poison" the H electrodes in the ordinary neutralization reactions. Poisoned electrodes can be restored to give normal values if treated with concd. HNO_3 .

W. G. GAESSLER

Some electrochemical studies of titanium. E. D. BORTS AND F. C. KRAUSKOPF. *J. Phys. Chem.* 31, 1401-19 (1927).—A study of the electrode potential of Ti in solns. of titanous salts with and without the addn. of acids and neutral salts. Methods of prep. pure Ti were investigated and the purest Ti was obtained by reduction of pure TiCl_4 with Na in a steel bomb. The electrode potentials of Ti in $M/4$ solns. of TiCl_4 and $\text{Ti}(\text{SO}_4)_2$ were 0.23 and 0.18 v., resp. (H standard). Addn. of a trace of H_2 increases the potential 0.22 v. HCl and H_2SO_4 cause a decrease in potential while alk. salts give the usual slight increase. Replacement expts. do not agree with the e. m. f. measurements except in the solns. contg. HF . These phenomena are discussed and the similarity to Si is emphasized.

* R. E. GIBSON

Electromotive force of flame. A. SYSOYEV. *Ukrainskii Khim. Zhurnal* 2, 185-6 (*Chem. Zentr.* 1926, II, 2393).—A Pt wire was stretched 5-10 mm. from a Pt foil anode, a fragment of salt was heated before the wire, with a fine pointed flame so that the salt vapor reached the wire first and then the foil. The wire was positive and the foil negative. The p. d. increased as follows: $\text{LiCl} < \text{Li}_2\text{CO}_3 < \text{CaCl}_2 < \text{TiCl}_4 < \text{SiCl}_4 < \text{NaNH}_4\text{SO}_4 < \text{NaCl} < \text{BaCl}_2 < \text{AcONa} < \text{Na}_2\text{CO}_3 < \text{NaNO}_3 < \text{KCl} < \text{RbCl} < \text{CsCl} < \text{K}_2\text{SO}_4 < \text{KNO}_3 < \text{K}_2\text{CO}_3$, that of LiCl being 0.003 v. and of K_2CO_3 0.67 v. The elec. dissocn. const. increases with rise of temp. and distance between the electrodes. When the foil is in a salt soln., the dissocn. const. is smaller and of the opposite sign. With a H flame, higher values of the dissocn. const. were obtained. The phenomenon is analogous to the opposite dissocn. const. of the luminous anode, where the more strongly heated anode is positive.

C. C. DAVIS

Anode oxidation of formic acid. FRANZ FISCHER AND WALTER KRÖNIG. *Abhandl. Königl. Preuss. Akad. Wiss. Berlin* 7, 244-8 (1925); *Chem. Zentr.* 1926, II, 1621.—When concd. HCO_2H containing HCO_2Na was electrolyzed, there was no evidence of evolution of gas (CO_2) at the anode. It was assumed therefore that a solid intermediate product was formed. Actually very small quantities of a product, probably cryst., were isolated, but this could not be identified as a per-compd., as oxalic acid or an mesoxalic acid. It was possibly methanetetra-carboxylic acid.

C. C. DAVIS

Experiments on the construction of isothermal gas concentration cells. FRANZ FISCHER AND WALTER KRÖNIG. *Abhandl. Königl. Preuss. Akad. Wiss. Berlin* 7, 231-43 (1925); *Chem. Zentr.* 1926, II, 1621.—It was attempted to construct isothermal H and O concn. cells such a way that 1 electrode, adjusted to the potential of the gas, drives the ions of this gas into soln., while the other electrode utilizes the heat of the surroundings to prevent condensation or alloy formation of the electrolytically sepd. gases which reach this second electrode. In this way the latter maintains its potential. The

cells investigated included Ni|NaOH|Ag, Cu|NaOH|Ag, Ni|NaOH|C, Ag|NaOH|C, Ag|H₂O|C, Pt|NaOH|Ag, Pt|NaOH|Cu, Pt|NaOH|C, Pt|H₂SO₄|C, Pt|NaH|Au, Pt|NaOH|Cu₃Sb, Pt|Na₂S|C and Ni|Na₂S|C under all practicable pressures. All cells studied were subject to polarization. C. C. DAVIS

The formation of formic acid by the electrolysis of aqueous salt solutions above the critical temperature. ALBERT JAEGER. *Abhandl. Kenntnis Kohle* 7, 201-8(1925); *Chem. Zentr.* 1926, II, 1401.—The object of the expts. was to det. whether it is possible to electrolyze aq. salt soln. above the crit. point, and if so whether the H evolved would reduce at the cathode the CO or CO₂ to HCO₂H, MeOH or similar products. Na₂CO₃ and NaHCO₃ solns. were electrolyzed at 400°, and in each case HCO₂H was identified. Attempts to reduce CO and CO₂ to HCO₂H by bringing in contact in an autoclave alk. electrolytes and these gases yielded neither HCO₂H nor any other product of an extensive reduction. When the C anode was surrounded with a diaphragm and Na borate used as an electrolyte so little HCO₂H was formed compared with the yields in the other expts. that it may be assumed that the HCO₂H originates both by anode oxidation of C and by cathode reduction of CO and CO₂. C. C. DAVIS

Demonstration of the Schönherr-Hessberger nitrogen-fixation arc. G. I. FINCH. *Proc. Phys. Soc. London* 34, 464-5(1927).—The Schönherr-Hessberger arc differs fundamentally from the Birkeland-Eyde and Pauling arcs, in that it has in fact a hot cathode and therefore produces a low-tension arc. A small-scale demonstration arc is described. GEORGE CALINGAERT

Experimental proof of electric dipole moments in dissolved molecules of the type Ca₄. L. EBERT AND H. V. HARTEL. *Naturwissenschaften* 15, 669-70(1927).—The authors investigated the presence of a measurable dielec. orientational polarization P_0 of a no. of substances of the Ca₄ type in benzene soln. From P_0 can be calcd. μ , the elec. dipole moment. For concns. of 6.71 and 29.11×10^{-3} of C(OCH₃)₄ was found $P_0 = 14$ and 10 , i. e., $\mu = 0.8 \times 10^{-18}$; for C(OC₂H₅)₄ at $c = 4.07$ and 16.7×10^{-3} followed $P_0 = 29$ and 16 , $\mu = 1.1 \times 10^{-18}$; for C(CH₃)₃OC₂H₅ at $c = 1.35$ and 5.78×10^{-3} was found $P_0 = 154$ and 94 , $\mu = 2.6 \times 10^{-18}$; for C(CH₂Cl)₄ at 9.58×10^{-3} concn. $P_0 = 2$, $\mu = 0.2$ if any, for CCl₄ at $c = 3.69 \times 10^{-3}$, $P_0 = 1$, $\mu = 0.1$ if any. P_0 was found from $P_0 = P - P_{\text{solid}}$, and P_{solid} from $\frac{E_{\text{sol}} - 1 M}{E_{\text{sol}} + 2 d_{\text{sol}}}$. The accuracy in P was 2 units.

The decrease of P_0 with increasing concn. is due to association; μ was therefore calcd. from the lowest P_0 value. The results prove for the mols. with positive μ the presence of a C atom with pyramidal valences. B. J. C. v. D. H.

The decomposition of some organic substances by the electric spark. N. R. FOWLER AND E. W. J. MARDLES. *Trans. Faraday Soc.* 23, 301-6(1927).—The primary of an induction coil is connected to a Wehnelt electrolytic interrupter, 8 amp. being passed. The secondary is connected to 2 adjustable C electrodes, set in the sides of a flask, contg. 200 cc. of the liquid to be tested, the spark being a hissing flame, 0.5-1 cm. long, and passing below the surface of the liquid. Expts. are made with paraffin oil (d. 0.82, b. 182-300°) (I), C₆H₆ (pure crystallizable) (II), aniline (III), 2-methylaniline (IV), 1-methylaniline (V) and EtOH (VI). On passing the spark for an hr., they gave from a trace to 0.11 g./min. C; 50-450 g./min. of evolved gas, consisting of 35-70% H₂, 20-60% methane and 1.5-5% acetylene and other unsatd. hydrocarbons. Further, VI gave 38% CO, III, IV and V small amts. of HCN. A high-b. p. liquid was left as a residue by I, a thick yellow liquid by II and tars by the anilines. VI was used in the vapor phase as attempts to pass sparks through the liquid were unsuccessful. After sparking the anilines for a short time, the discharge stops, the liquid heating rapidly, but on redistn. and removal of HCN this may be repeated. In exptg. with acetylene the gas was contained in a bulb having Cu electrodes and using a current of 2 amp. On turning the current, the gap is bridged with C threads which prevent further discharge. By shaking, this may be repeated a no. of times. Small amts. of air, added to the acetylene, give no different results, while large amts. produce an explosion. The greater the voltage used, the higher is the yield of free element. J. BALOZIAN

The potential of a proposed standard form of copper and the activity of copper sulfate. R. F. NIELSEN AND D. J. BROWN. *J. Am. Chem. Soc.* 49, 2423-8(1927).—Since the potential at Cu electrodes depends on the method of prepn. of the electrodes an easily reproducible form of Cu giving const. results has been sought. Such an electrode is a 2-phase amalgam prepd. by electrolysis of a half-molal soln. of CuSO₄ slightly acidified, using about 5 amps. per sq. dm. of Hg surface, and a Cu anode. After prepn. the amalgam was kept under this soln. The e. m. f. of cells of the type: Cu (amalgam) | CuSO₄ (x M) | HgSO₄ | Hg were detd. when the value of x was 0.05, 0.1, 0.2, 0.5 and 1.38 (satd.) and from these values the activity coeffs. of CuSO₄ were

found to be 0.216, 0.153, 0.107, 0.064 and 0.0378, resp., the first value being taken from the results of Lewis and Randall.

The use of amalgam electrodes for determining activities in methanol. J. H. WOLFENDEN, C. P. WRIGHT, N. L. R. KANE AND R. S. BUCKLEY. *Trans. Faraday Soc.* 23, 491-8(1927).—The cell $\text{Na}(\text{Hg})_x \mid \text{NaCl in MeOH} \mid \text{AgCl:Ag}$ was studied over a range of 0.1 *M* to 0.0005 *M*. A description of the cell is given. E. m. f. measurements depend on rate of flow and below 0.005 a second factor, not known, causes results too low to give ionic activities calcd. from the Debye and Hückel equation.

R. H. LAMBERT

Electromotive force of the cell with transference and theory of interdiffusion of electrolytes. P. B. TAYLOR. *J. Phys. Chem.* 31, 1478-1500(1927).—A general expression for the e. m. f. of the cell with transference has been derived in terms of the corresponding cell without transference. Correction has been made for transference of the solvent and for diffusion of the electrolyte. The latter is dependent on mol. free energies only and not on ionic free energies. A cell with transference should be set up to form a junction with initially a sharp boundary between electrolytes and thereafter to let these diffuse undisturbed. The formula for liquid junction potential differences is extended to provide for variable mobilities and activity coeffs. A critical use of $p_{\text{H}_2\text{O}}$ with regard to the electrolyte used is urged.

R. H. LAMBERT

The electrochemical behavior of silver and copper amalgams. KURT ARNDT AND GEORG FLORITZ. *Chem.-Ztg.* 51, 461(1927).—To det. the actual potential that might arise in the human mouth when two teeth are filled with different metals the authors studied the amalgams most frequently used. The standard alloy, 50 Sn, 45 Ag, 5 Zn, Cu and Ni, was obtained and introduced into Hg, slightly heated. The excess of Hg was removed by pressing through a linen cloth. An electrode with 1.2 sq. cm. surface was prep'd of this amalgam and its potential measured against a standard 0.1 *N* HgCl electrode. Solus. of 1% NaCl, 1% lactic acid and mixts. of the two were used. The potential found corresponds to that of Sn. Similar expts. with Cu amalgam gave a potential corresponding to Cu. Only very slight potentials were obtained when the amalgams were measured against pure gold.

C. G. F.

Critical résumé of recent electron theories of electrical and thermal conduction in metals. ERICH KRETSCHMANN. *Physik. Z.* 28, 565-92(1927).—A thorough résumé of exptl. results and theories, too extensive and detailed to be abstracted.

A. E. RUARK

Electrolytic conduction in molten alloys. XVII. Electrolysis of alloys of zinc with lead, bismuth and cadmium, of antimony with lead and bismuth, and of cadmium with lead and bismuth. R. KREMANN AND ANDREAS TRÜSTER. *Monatsh.* 47, 285-93 (1926).—The exptl. procedure was the same as that in previous investigations. Difficulties were encountered rendering the results uncertain except with Bi-Cd alloys for which data are given for 25, 50 and 75 at. % Bi. Electrolysis was maintained for 20 hrs. in each expt. Bi accumulates at the anode, the electrolytic effect increasing with c. d. up to 5.6 amp / sq. mm. The max. effect is found with the 50% alloy resulting in a 65% change in the concn. of Bi. **XVIII. Summary of the results of this series of papers.** R. KREMANN. *Ibid* 295-306.—The process of accumulation of the constituents of an alloy at the electrodes is the result of a balancing of the motion of the constituents under the applied e. m. f. by the process of diffusion. For a given alloy the stationary state, produced by electrolyzing the molten alloy during 3 to 24 hrs., appears to be only slightly dependent on temp. The phenomenon is likened to the process of diffusion in a gas mixt. With some alloys the resultant effect is very small at elevated temps., but this is to be ascribed to the sp. properties of the metals in question (e. g., Bi Pb) rather than to any general effect of high temp. The max. effect is always encountered in the neighborhood of 50 at. % alloy. Constituents of decidedly metallic character migrate to the cathode, resulting in a concn. of the more metalloidal constituent at the anode (e. g., Bi). The series Hg, Ne, A, Bi, Sb, Hg, Pb, Sn, Zn, Cd, Cu, Ag, Al, Na, K is in the order of the increasing tendency to migrate away from the anode, and is roughly in the order of decreasing ionization potentials, except for the positions occupied by Pb and Al. The electrolytic effect is not directly proportional to the difference of the ionization potentials of the constituent metals, indicating that the current is carried partly by electrons, and partly by material transport. The presence of inter metallic compds. further affects the electrolytic effect.

F. C. KRACEK

Continuous transition between ionic and electronic conduction. C. TUBANDT, E. RINDORFF AND W. JOST. *Z. anorg. allgem. Chem.* 165, 195-220(1927).—The nature of the elec. cond. of solid CuI was detd. The α - and β -modifications are purely electrolytic conductors, the Cu^+ alone being mobile. The γ -modification is a mixed

conductor, showing purely electronic cond. up to 240° and purely ionic cond. above 390° , the transition being gradual between 240° and 390° . The temp.-cond. curve was detd. between 10° and 700° . The m. p. (602°) and transition point $\beta \rightleftharpoons \gamma$ (402°) are marked by sharp breaks in the curve. There is no indication of a transition $\alpha \rightleftharpoons \beta$, which is reported to be at 440° . A min. occurs at approx. 325° , where there is 50% electronic and 50% ionic cond. •Addn. of I_2 to CuI causes an increased cond. which is of a metallic nature. Similarly for $CuBr$ and $CuCl$ there is a transition from electronic cond. at low temps. to ionic cond. at high temps.

J. E. SNYDER

Electrical conductivity of mixtures of sulfuric and phosphoric acids. J. MEYER AND A. PAWLETTA. *Ber* 60B, 551-3(1927).—A perfectly normal, mutual influence of the dissociation relationships is observed in mixts. of H_2SO_4 and H_3PO_4 . Contrary to Pessel (*C. A.* 17, 2403), there is no evidence of chem. reaction between the acids.

B. C. A.

The electrical conductivity of vapors and liquid drops during incipient combustion. J. A. J. BENNETT. *Trans. Faraday Soc.* 23, 295-301(1927).—Studies are made of the phys. aspects of slow combustion by Mardles' method. Air is bubbled through (for a rich mixt.) or over (lean mixt.) the liquid in a vaporizer. The mixt. is then passed through a glass (quartz is used for higher temps.) combustion tube in an electric furnace having temp. control. In the tube are set, about a cm. apart, 2 thick $Pt(Au)$ foil electrodes $1/8$ cm. sq., a Pt and $Pt-Rh$ couple being welded to the anode. The p. d. across the electrodes is 30 v., the current being read by a Kelvin galvanometer. The cond. of lean mixts. of air and vapors of various org. compds. is due to deposits on the electrodes. Rich mixts. of the less volatile compds. are ionized above 400° , but not until a thick fog had appeared. In order to prevent fouling of electrodes or tube, the time of an expt. should be as short as possible. The chem. activity of Pt is due to surface combustion as shown by a curve of furnace temps. against electrode temps. for a 50% mixt. of H_2 -air. Liquid drops, similar to vapors, have no measurable cond. before fog formation. As is shown by curves of undecane mixed with antiknockers, N compds., aromatic bases, phenols, and alcs., cond. increases exponentially with temp. from 300° to 500° . Although it lowered the initial temp. of combustion, ultra-violet light does not cause an appreciable increase in ionization, or cond., that noted being due to fouling of the electrodes. Thus in the slow combustion of liquid drops of org. compds. in air electrons are present in large nos., while in vapor-air mixts. there are relatively few, which conclusions are used to explain ignition in internal-combustion engines.

J. BALOZIAN

Electrical conductivity at low temperatures. J. C. McLENNAN AND C. D. NIVEN. *Phil. Mag.* [7], 4, 386-404(1927).—The resistance-temp. curves of Pb , Cd and In were investigated and the results found confirmed the work of other experimenters. Resistance-temp. curves of samples of Be , Cr , Ru and Th were investigated. The results showed that the temp. gradient was small for all pure metals at very low temps. except for those that were superconducting; and even in the case of the latter the temp. gradient rapidly diminished just before the sudden disappearance of the resistance. The results obtained for Cr showed it to be a fairly poor conductor with a steep temp. gradient at room temp. The effect of aging electrolytic Cr was to reduce its sp. resistance at room temp. from 44 to 17 microhms; the very high value for the electrolytic Cr was due to occluded gas, and when this was driven off the resistance-temp. curve was moved down towards the temp. axis with very little alteration in its shape. The resistance of Ru was measured at $2.63^{\circ} K$, and no sign of superconductivity was apparent. The resistance-temp. curve of an alloy of Na and K was investigated down to the temp. of liquid H_2 . It resembled the curves for the pure metals composing it; the curve for the alloy indicated a much higher resistance at $0^{\circ} K$. than the residual resistance of either Na or K .

GEORGE GLOCKLER

Fortuitous thermoelectric currents in bismuth. G. TODESCO. *Nuovo cimento* [N. S.], 4, 94-103(1927); cf. *C. A.* 21, 2215.—Using a ring of Bi suspended between the poles of a magnet and carrying a small mirror to measure the degree of deflection, T. has systematically measured the current intensity obtained as a function of the angular position of the region subjected to luminous radiation. Rings prepd. by various heat treatments as well as by compression of powd. Bi were studied. The diverse thermoelectric currents noted are ascribable to the orientation of the elementary crystals in the structure of the metal.

L. T. FAIRHALL

The relation between conductivity and thermoelectric power in the magnetic field. V. GIAMBALVO. *Nuovo cimento* [N. S.], 4, 176-80(1927).—Thermoelectric forces were measured in Sb with and without the application of a magnetic field. Measurements of resistance were similarly made. The curves representing the specific varia-

tions in resistance and thermoelectric power show a difference in character for the 2 phenomena. For weak fields $\Delta P/P_0$ varies more rapidly than $\Delta r/r$, while for more intense fields the latter continues to increase rapidly and the former tends to assume a const. value. Notwithstanding the difference in sign of Hall's coeff., Sb and Bi behave the same with respect to the action of the field on their motile corpuscles.

L. T. FAIRHALL

Action of the magnetic field on optically active substances. G. CALCAGNI. *Notiz. chim. ind.* **2**, 429(1927). The solns. were exposed to a magnetic field by winding the polarimetric tube with wire (0.8 mm. diam.) and utilizing a d. c. of 7.5 amp. and 23 v. This app. gave consistent results and did not heat the soln. enough to influence the precision. Water, solns. of glucose, sucrose, tartaric acid and tannic acid, *dl*-lactic acid, *AmOH*, eucalyptus oil and castor oil were tested. The additional rotation which was produced by the magnetic field was manifest immediately and these increments, the sign of which depended upon the direction of the current, were equal whether positive or negative. The additional rotation was independent of the nature of the substance and of its concn., and the values were in all cases 2.0-2.5°. Moreover with optically inactive substances, *i. e.*, water and *dl*-lactic acid, the additional rotation was the same as that with the active substances. The results in general indicate that the effect of the magnetic field is exercised on the light, which is of an electromagnetic nature, and as in the Zeeman effect, the magnetic field acts on the trajectories of the electrons which produce the light.

C. C. DAVIS

Properties of active iron compounds. A. BICKEL AND C. VAN EWEYK. *Biochem. J.* **18**, 178-80(1927); cf. Baudisch, *C. A.* **20**, 438. Three iron preps. (1) active Fe (Baudisch), (2) a non-magnetic "ferro-ferricarbonate," extraordinarily active toward benzidine and (3) a non-magnetic oxide prep'd by heating (2), also strongly active toward benzidine, were covered with cond. H_2O and with distd. H_2O and exposed to one lab. atm. for 5 months. No change in activity took place. Therefore, the active character of the mineral water, which soon loses its activity, must be very different from the (1). The activity is probably due to active mols. or mol. complexes rather than to the same condition of the system.

S. MORGULIS

Paramagnetism and the third law of thermodynamics—interpretation of the low-temperature magnetic behavior of gadolinium sulfate. W. F. GIAUQUE. *J. Am. Chem. Soc.* **49**, 1870-7(1927).—An equation involving only natural const. is derived from thermodynamically and it is shown that the values of the magnetic susceptibility of $Gd_2(SO_4)_3 \cdot 8H_2O$ agree quant. with it. Among the possible applications of this equation which are suggested are paramagnetic thermometry at low temps., and low-temp. calorimetry. Calcn. of the abs. value of the entropy of substances having a positive magnetic susceptibility is discussed.

W. W. STIFLER

Magnetic susceptibility of some binary alloys. J. F. SPENCER AND (MISS) M. E. SPENCER. *Proc. Roy. Soc. (London)* **A116**, 61-72(1927).—The relation between mass susceptibility and compn. was studied for a series of binary alloys. In the $Ag-Pb$ system, the alloy contg. about 29.2% Pb shows a pronounced max. value for the susceptibility, indicating a possible compd. Ag_3Pb_2 . The alloys contg. 55 and 0.9% Pb are non-magnetic. Au-Pb alloys contg. approx. 62 and 56% Pb, resp., are non-magnetic, while the 94% Pb alloy is approx. 10 times as strongly diamagnetic as either pure Au or Pb. All alloys of Au-Sn contg. more than 6% Au are diamagnetic. The magnetic behavior indicates the formation of the compd. $AuSn_3$, but there is no indication of the formation of $AuSn$ or $AuSn_4$, which (in addition to $AuSn_3$) are indicated by freezing pt. curves. The Au-Cd alloys contg. 22, 47, 60 and 94% Cd are non-magnetic and the others have only small pos. or neg. susceptibilities. The magnetic data indicate the diamagnetism of $AuCd_4$ but do not show $AuCd$ or Au_4Cd_3 , though all three are indicated by freezing pt. curves. Although both Al and Sn are paramagnetic, all the Al-Sn alloys are diamagnetic. There is some evidence of the formation of Al_4Sn_3 . All the Fe-Sn alloys are diamagnetic. The compd. Sn_4Bi_3 is indicated. The Cd-Sn alloys contg. less than 67% Sn are diamagnetic. The formation of $SnCd_3$ is indicated. The susceptibility-compn. curve for the Pb-Sn series is practically linear, decreasing steadily from the value for pure Sn to that of pure Pb. The alloy contg. approx. 70% Sn is non-magnetic. There is no evidence of intermetallic compds. Besides the curves, full numerical data for each series are given.

W. W. STIFLER

Magnetic properties of vanadyl chloride and sulfate and the atomic moment of quadrivalent vanadium. NICOLAS PERRAKIS. *Compt. rend.* **184**, 1430-4(1927).—Expts. on $V_2O_4Cl_4 + 5H_2O$ between -79° and $+53^\circ$ indicate that the quadrivalent V ion has a moment corresponding to 8 Weiss magnetons. Similar expts. on $VOSO_4 + 6H_2O$ over the range -79° to 100° indicate a magnetic moment of 9 Weiss mag-

netons. In both cases the requirements of the Curie law are met though the Curie temp. is not always the same.

W. W. STIFLER

Magnetic study of the tetraoxide and the trioxide of vanadium, measurement of the atomic moment of quadrivalent and trivalent vanadium. NICOLAS PERRAKIS. *Compt. rend.* 185, 111-3(1927).—Between -79° and $+52^{\circ}$ the coeff. of magnetization of V_2O_4 corresponds to the equation $X_A(T + 398.4) = 0.322$, indicating a magnetic moment of 7.98 magnetons. From 52° to 60° there is a rapid increase, after which it again decreases up to 163° , according to the equation $X_A(T + 1108) = 0.992$, indicating a moment of 14.00 magnetons. The value 8 agrees with previous results for V^{IV} (see preceding abstract) while 14 agrees with the moment of V^{III} as found by Cabrera. However, P. found no evidence of dissoci. of V^{IV} into V^{III} . Measurements on V_2O_5 showed a similar, though not as abrupt change between 47° and 67° . The lower temps. gave results that satisfy $X_A(T + 483.9) = 0.457$ while for the higher temps. the results give $X_A(T + 577.3) = 0.460$, indicating 9.50 and 9.53 magnetons, resp. This is $1/2$ magneton higher than found previously for V^{IV} .

W. W. STIFLER

Magnetic anisotropy of crystalline nitrates and carbonates. K. S. KRISHNAN AND C. V. RAMAN. *Proc. Roy. Soc. (London)* A115, 549-54(1927).—In crystals of $NaNO_3$ and KNO_3 the susceptibility perpendicular to the plane of the NO_3 ion is greater than for directions in this plane. This difference in the susceptibilities is the same for both crystals. On the assumption that this anisotropy is due to the NO_3 ion, its value is computed from the known value of the magnetic birefringence (Cotton-Mouton effect) of HNO_3 . The computed and exptl. values agree satisfactorily. Similar anisotropy is found for the CO_3 ion. An explanation based on the electronic structure is suggested.

W. W. STIFLER

Thermodynamic treatment of certain magnetic effects—a proposed method of producing temperatures considerably below 1° abs. W. F. GIAUQUE. *J. Am. Chem. Soc.* 49, 1864-70(1927).—By thermodynamic reasoning G. shows that the entropy change accompanying the magnetization of a paramagnetic substance such as $Gd_2(SO_4)_3 \cdot 8H_2O$ at extremely low temps. might furnish a means for reaching a temp. considerably below 1° abs. At such a temp. the direct detn. of the no. of magnetons in paramagnetic substances should be possible.

W. W. STIFLER

The thermodynamic properties of a few concentrated salt solutions. H. S. HARNED. *Trans. Faraday Soc.* 23, 462-70(1927).—Activity coeffs. for strong acids in homoanionic and strong bases in homocationic salt solns. are compared. By making certain assumptions, peculiarities of some unsymmetrical ions can be explained. Cf. C. A. 20, 3632.

R. H. LAMBERT

The entropy change on melting. I. The dependence of the entropy change on the atomic number. E. KORDES. *Z. anorg. allgem. Chem.* 160, 68-76(1927).—The entropy of melting of the elements is a periodic function of the at. no. with maxima at the halogens and minima at the alk. metals. The periodicity is complicated by the different complexity of the various forms of the same element.

F. R. B.

The absolute constant of entropy and its applications. FRANCO RASETTI. *Nuovo cimento* [N. S.], 3, 67-86(1926).—A math. and more or less historical discussion. R. concludes that classical thermodynamics is insufficient for calcg. a chem. equil. completely from measurements of reaction energy. If one calcs. the entropy of a perfect monatomic gas by means of statistical mechanics, a value is obtained contg. an arbitrary const. By introducing a quantum hypothesis one can det. an abs. value of entropy. A consideration of the relation existing between the quantum states of the atom and the const. of entropy of a gas shows that a precise theoretical detn. of the const. of entropy for polyatomic mols. is impossible until more exact knowledge of their quantum states, i. e., their band spectra has been obtained.

L. T. FAIRHALL

Absolute zero of entropy and internal energy. J. E. VERSCHAFFELT. *Phil. Mag.* [7], 4, 335-7(1927).—V. does not accept the conclusion of Kleeman (C. A. 21, 2416) that the conditions $(\partial U/\partial T)_v = 0$ and $(\partial S/\partial T)_v = 0$ at $T = 0$ are necessary mathematical consequences of the fact that U and S are min. for $v = \text{const.}$ at the abs. temp.

GEORGE GLOCKLER

Properties at the absolute zero of temperature of the quantities associated with the reversible mixing of substances. R. D. KLEEMAN. *J. Phys. Chem.* 31, 1559-65(1927).—As in previous papers (C. A. 21, 2416, 2594) total entropy and total internal energy are divided into externally uncontrollable and controllable parts. Thermodynamic equations are derived for the properties of substances and mixts. under their vapor pressures at the abs. zero of temp.

E. R. SMITH

Properties of substances in the condensed state at the absolute zero of temperature. R. D. KLEEMAN. *Phil. Mag.* [7], 4, 257-68(1927); cf. C. A. 21, 2215, 2416, 2594.

On the basis of his division of energy, entropy, etc., into controllable and non-controllable parts, K. derives a number of thermodynamic formulas which are said to hold for condensed systems at the abs. zero.

GEORGE GLOCKLER

The theoretical impossibility of absolute zero and a relation between this postulate and the theorem of Nernst. A. SCHIDLOF. *J. chim. phys.* 23, 814-20(1926).—The assumption of the impossibility of abs. zero may be made explicit by assuming that the ratio of heat absorbed to the temp. in a reversible cycle operated near zero abs. approaches zero as the temp. approaches zero. It may now be deduced that sp. heat and coeff. of expansion approach zero as temp. approaches zero. The axiom of Clausius leads to the same results if the quantity of heat transported is always kept finite.

F. R. BICHOWSKY

The thermal decomposition of hydrogen peroxide vapor. L. W. FIDER, JR. AND E. K. RIDEAL. *Trans. Faraday Soc.* 23, 545-52(1927).—An app. is described for the measurement of the rate of decompn. of H_2O_2 vapor in const. vol. A method is described for prepg. pure concd. H_2O_2 from the urea- H_2O_2 cryst. compd. known as "Hyperol." The vapor under about 85 mm. pressure at 85° is shown to be composed of simple mols., free from any measurable hydrate. The thermal decompn. on quartz at 85° is a zero-order reaction inhibited by O_2 , which stops about 80% short of completion. On Pt wire, H_2O_2 vapor undergoes an apparently unimol. decompn. which is shown to be very probably detd. by the rate of diffusion through an adsorbed or dissolved layer of O_2 . The reaction on a Hg surface consists of a preliminary direct oxidation of Hg to Hg_2O , followed by coupled oxidation of Hg_2O to HgO , in which an amt. of O is liberated proportional to the amt. of HgO formed. It is shown that HgO is not reduced by H_2O vapor.

A. L. HENNE

A study of the thermal decomposition of nitrogen pentoxide. F. O. RICE AND DOROTHY GETZ. *J. Phys. Chem.* 31, 1572-80(1927).—The velocity const. of the decompn. of N_2O_5 was detd. under dust-free conditions but no evidence was obtained to show that the decompn. is a dust reaction. The velocity const. was the same when P_2O_5 was used in the prepn. and drying of the N_2O_5 as when no P_2O_5 was used, thus showing that there is no catalyst connected with the use of P_2O_5 . N_2O_5 is more stable in 100% HNO_3 than in the gas phase or in soln. in org. solvents. The rate of decompn. in CCl_4 soln. was measured by a new method.

E. R. SMITH

The decomposition of hydrogen sulfide. H. AUSTIN TAYLOR AND C. F. PICKETT. *J. Phys. Chem.* 31, 1212-9(1927).— H_2S was passed at a measured rate of flow over an electrically heated Pt filament and the effluent gases were analyzed for H_2S and H_2 to det. the extent of decompn. The expts. were carried out at 948° , 1041° , 1138° and 1269° . The mechanism of the reaction appears to consist primarily of adsorption of H_2S mols. on the Pt surface, their decompn. resulting in a liberation of H_2 and vaporization of S from the surface. The heat of evapn. of S from the Pt is calcd. as 11,750 cal.

E. G. VANDENBORCH

Heat transfer alignment charts. MAURICE ROUILLEUX. *Chem. Met. Eng.* 34, 148-51(1927).—Two charts are given, one of which is for calcg. logarithmic mean temp. difference, the other for calcg. the desired heating surface when mean temp. difference, heat transfer coeff., and total heat transferred are known.

W. L. B.

Heat conduction of solids. GEO. G. BROWN AND C. C. FURNAS. *Trans. Am. Inst. Chem. Eng.* 18, 295-307(1926).—"New differential equations representing the law of heat conduction are derived without making the simplifying assumptions that the thermal cond. and sp. heat are const. These equations are solved by graphical methods and applied to the detn. of thermal conductivities, sp. heats and heats of transition or reaction." A solid cylinder with a center axis consisting of a heating element giving even distribution of heat throughout its length is employed. A bibliography is included.

W. H. BOYNTON

The connection between heat of fusion and specific heat. KARL LICHTENECKER. *Physik. Z.* 28, 473-5(1927).—The fact that the heat of fusion of ice corrected for the work done is close to the heat content of the ice itself, is discussed in relation to the degrees of freedom of the mols. and the rigidity of the ice crystal.

F. O. A.

The metastability of the elements and compounds as a result of enantiotropy or monotropy. X. The true specific heat of chemically and physically pure white and gray tin. ERNST COHEN AND K. DO. DEKKER. *Z. physik. Chem.* 127, 183-217(1927); cf. *C. I.* 18, 1930. —From white Sn whose purity was thoroughly established, chemically pure gray Sn was prepd.; its purity was detd. pycnometrically and by means of x-rays. The d. of chemically and physically pure white Sn at 13° referred to H_2O at 4° is 7.285. Under similar conditions, equally pure gray Sn is 5.765. The true sp. heat of gray Sn

is 0.0493 ± 0.0002 for the temp. interval 8° to 13° , whereas the value for white Sn is 0.0537 ± 0.0003 for the temp. interval of 13° to 18° . J. H. PERRY

Calorimetric study of certain salts. EMMA CANE. *Rend. accad. sci. Napoli* **32**, 83-7(1926).—The sp. heats of the following salts at 13° to 25° , as detd. by a Bunsen calorimeter, are: CaMoO_4 , 0.166; PbMoO_4 , 0.098; BaMoO_4 , 0.113; $\text{Y}_2(\text{MoO}_4)_3$, 0.159; SrMoO_4 , 0.149; $\text{Ce}_2(\text{MoO}_4)_3$, 0.126; $\text{La}_2(\text{MoO}_4)_3$, 0.114; PbWO_4 , 0.077; CaWO_4 , 0.104. The calcd. av. mol. heat of the group, MoO_4 , is 26.5; and its values as calcd. from the above compds. are considered to be sufficiently const. to indicate that the mol. heats of these salts follow an additive law. R. H. LOMBARD

The latent heat of evaporation of sulfur. J. H. AWBERRY. *Proc. Phys. Soc. London* **39**, 417-20(1927).—The latent heat of evapn. of S was detd. by finding the loss of wt. of a vessel full of S when energy was dissipated in it at a known rate. Heat losses were prevented by immersing the vessel in S vapor. A method of correction for heat loss by having a dummy vessel with a smaller heating coil and using the differences in energy and in wt. evapd. for the two vessels, was tried but gave unsatisfactory results. The latent heat of S was found to be 79 cal./g. $\pm 2\%$. GEORGE CALINGAERT

Measurements of heat of combustion of calcium cyanamide and calculation of heat of formation therefrom. NAOTO KAMEYAMA AND SOJIRO OKA. *J. Soc. Chem. Ind. (Japan)* **30**, 317-23(1927).—See C. A. **21**, 2416. SHUMPEI OKA

Heats of adsorption of several gases and vapors on charcoal. F. G. KEYES AND M. J. MARSHALL. *J. Am. Chem. Soc.* **49**, 156-73(1927).—The heat of adsorption of O, Cl, CO_2 , NH_3 , Et_2O , chloropirrin and water on gas-mask charcoal was measured in an ice calorimeter. The heat at large concns. varies almost linearly with $4A/\beta$, where A and β are van der Waals' consts. F. R. B.

The reversible mixing of substances in the condensed state at the absolute zero of temperature. R. D. KLEEMAN. *Science* **66**, 216-7(1927).—The results of mathematical reasoning are stated. The internal heat of mixing or the increase in internal energy on mixing a number of substances is 0 at abs. 0 if the substances and the resultant mixt. are under the pressures of their vapors. By approximation, at temps. near the abs. 0, the internal heat is proportional to the cube of the temp. If, then, the sp. heats are known, the proposition can be tested exptly. Under the same conditions of mixing, there would be no change in internal energy or entropy. A. W. K.

The partial heat capacity of the constituents and the specific heat of aqueous solutions of sodium and hydrogen chlorides. MERLE RANDALL AND W. D. RAMAGE. *J. Am. Chem. Soc.* **49**, 93-100(1927).—By using twin calorimeters and the direct method of measuring partial quantities the heat capacity of solns. of NaCl was measured at various temps., and that of HCl solns. at 25° . The partial molal heat capacity of the solute varied approx. as the sq. root of the molality in dil. solns., and that of the solvent as the 1.5 power of the molality. F. R. B.

The surface energy and the heat of solution of solid sodium chloride. I. S. G. LIPSETT, F. M. G. JOHNSON AND O. MAASS. *J. Am. Chem. Soc.* **49**, 925-43(1927).—The heat of soln. of cryst. NaCl and of NaCl prepd. by chilling the vapor were measured in a rotating adiabatic calorimeter. The connection between thermal and calorimeter was by radiation only. The accuracy claimed was 0.1%. The difference of heat of soln. of the 2 forms of NaCl was 3.5 ± 1.0 cal. i. e., the surface energy of the powder is about 400 ergs per sq. cm. NaCl shows a max. heat of soln. at a concn. of 1%. F. R. B.

Remarks on the correction of thermochemical data. W. SWIENTOSLAWSKI AND H. STARCZEWSKA. *J. chim. phys.* **23**, 821-2(1926).—A systematic method is given for correcting old thermochem. values for errors in the at. wt. assumed. This is illustrated by further correction of the results of Valeur (cf. C. A. **20**, 326). F. R. B.

A contribution to the thermochemistry of organic compounds. ENDRE BERNER. *Arch. Math. Naturvidenskab* **39**, No. 6, 5-134; *Chem. Zentr.* **1926**, II, 2537-8. The older formulas for the analysis of heats of combustion into individual factors, including those of Thomsen, Swientoslawski, von Weinberg, Fajans and Hückel, are assembled and in part critically examd. Within the exptl. errors, these investigations indicate that the energy of the C-H bond is the same as that of the C-C bond in *said.* and in *unsaid.* hydrocarbons. Nevertheless further and more precise measurements of the heats of combustion are to be desired. Only the data on gases are strictly comparable. Data on isomeric compds. are compared from a crit. point of view. New investigations were made of esters of different tartaric acids, symmetrical dimethylsuccinic acids, symmetrical diphenylsuccinic acids and hydrobenzoinis, whose configuration and other properties are itemized. To render comparable data on heats of combustion, heats of soln. can be utilized instead of heats of fusion, which are difficult to det. The follow-

ing data give the mol. heat of combustion at const. vol. (cals.) and the same corrected for the heat of fusion or heat of soln., resp.: dimethyl *d*-tartrate 618.56, 621.3; dimethyl racemate 617.60, 621.0; dimethyl mesotartrate 618.06, 621.7; diethyl *d*-tartrate 930.32, 930.3; diethyl mesotartrate 930.96, 931.6; diethyl rac. sym. dimethylsuccinate 1321.49, 1321.5; diethyl mesodimethylsuccinate 1322.6, 1322.6; diethyl rac. sym. diphenylsuccinate 2448.76, 2453.8; diethyl mesodiphenylsuccinate 2447.36, 2455.1; isohydrobenzoin 1718.57, 1723.2; hydrobenzoin 1719.07, 1724.1; stilbene 1759.0, 1760.8; isostilbene 1769.2, 1770.9. These values are more reliable than the previous ones published by B. (C. A. 13, 2516). The measurements were made with a Pt resistance thermometer, which was reliable to 0.0001°. The sources of error in the usual methods for detg. heats of combustion are discussed in detail. Compressed O may contain small quantities of CH₄. In calibrating with BzOH, the water equiv. decreased at first as the pressure of O in the bomb calorimeter increased, but after purification of the O with Pd-asbestos the equiv. became higher and const. Introduction of a layer which conducts heat poorly between the calorimeter and its jacket is undesirable. The influence of the vaporization of water and of errors due to the thermometer is detailed. The latter source of error is negligible when a Pt-resistance thermometer is used. Errors in weighing in the expts. described reached only a few hundred thousandths, and weighings were reduced to a vacuum. The heat of ignition (fusion of a constant Pt wire) was 0.8 cal. The cross-section of the calorimeter was not circular, but the screw stirrer rotating 260 times per min. moved in a small attached cylinder. The water jacket was also stirred. A Peters bomb plated with Au was used. The resistance thermometer had 25.5Ω at 0°, and $R_{100} - R_0 = 9.9180\Omega$. The measurements were made in a manner similar to those of E. Fischer and F. Wrede. The calorimeter was charged with 3700 g. of water, and on the latter floated a metal cover, so that hardly any water evapd. The heat exchange with the surroundings is shown graphically. The temp. was 18°. The O, CO₂, and H₂O contents were taken into account at all times. The following data were obtained. Me *d*-tartrate, m. 61.5°. Me racemate, m. 60°. Me mesotartrate, m. 114°. Et *d*-tartrate, d_4^{20} (vac.) 1.2047, n_D^{20} 1.4467. Mesotartaric acid, m. 58.0°. Sym. mesodimethylsuccinic acid, m. 193°. Rac. sym. dimethylsuccinic acid, m. 129°. Et mesodimethylsuccinate, n_D^{20} 1.4213. Et rac. dimethylsuccinate, n_D^{20} 1.4227. Sym. mesodiphenylsuccinic acid, m. 229–30°. Ethyl mesodiphenylsuccinate, m. 140°. Rac. sym. diphenylsuccinic acid, m. 222° (with CHCl₃ in 183°). Ethyl rac. diphenylsuccinate, m. 84.5°. Hydrobenzoin, m. 136°. Isohydrobenzoin, m. 119.5°. Stilbene, m. 124°. The uncertainty of the water equiv. was calcd. as 0.04 per thousand, and that of the heat of combustion as about 0.1 per thousand. The heats of soln. were detd. with a Beckmann thermometer, and the calorimeter was calibrated by measuring the heat of soln. of KBr in water.

C. C. DAVIS

Standardization of Professor T. W. Richards' thermochemical data. W. SWENSON, J. W. GLAND, and J. BOBINSKA. *J. Am. Chem. Soc.* 49, 2476–8 (1927).—The authors have recalcd. the heats of combustion of the org. compds. previously reported by Richards (C. A. 4, 1465; 9, 1422; 14, 2881) to make them conform to the new thermochemical standard unit, 1 g BzOH weighed in vacuum yields 6319 cal.₁₈°. The coeff. of standardization for the data of 1910, expressed in kilojoules, is 238.27; for that of 1911 and 1920, expressed in cal.₁₈°, is 0.99942. Tables or recalcd. values are given.

E. R. SCHIERZ

The relation between the heat of formation of salts and the volume of their components. OSCAR SCHUTZ and FRITZ EPHRAIM. *Helv. Chim. Acta* 9, 920–3 (1926).—Heat of formation of the halides of some metals varies linearly with the at. vol. of the halogen. Similarly the heat of formation of salts of the same halogen with different metals varies linearly with the at. vol. of the metal.

F. R. BICHOWSKY

Note on the rule of three temperatures. EDM. VAN AUBEL. *J. chim. phys.* 23, 261–2. A reply to criticism of Prud'homme (C. A. 19, 913.)

F. R. B.

The specific heat of a sufficiently chilled uncondensed phase. NICOLAS KOLODOZ. *Compt. rend.* 184, 322–3 (1927).—A criticism of the paper of Perrakis (C. A. 21, 3534).—Pointing out that he develops needless hypotheses.

D. H. POWERS

Specific heat of a phase condensed by sufficiently cooling. J. E. VERSCHAFFELT. *Compt. rend.* 184, 603–4 (1927).—A criticism of Perrakis (C. A. 21, 3534). Trouton's law states that L/T is the same for all normal substances at the normal b. p. but not that the quotient is independent of temp. The asymptotic approach of the saturation curve in the pv diagram to the axis $p = 0$, does not mean that p tends to remain const. but only that it tends toward zero.

H. M. McLAUGHLIN

A new base point on the thermometric scale and the $\alpha \rightleftharpoons \beta$ inversion of quartz. **FREDERICK BATES AND F. P. PHELPS.** *Bur. of Standards, Sci. Paper No. 557, Vol. 22, 315-27(1927).*—The temp. of inversion of α to β quartz was detd. by thermocouples inserted in holes in cryst. quartz plates. The start of the inversion occurs sharply at 573.3° and the temp. then drops quickly to 572.7°. Heating and cooling curves are given. The temp. at which inversion starts may be used as a new fixed thermometric point. A thermocouple may be inserted in a hole drilled in a small piece of clear crystal quartz or even simply placed in contact with it. If the furnace heating is sufficiently slow a marked change in the rate of temp. rise will be noted at 573.3°.

R. W. RYAN

Accuracy of measurement in determining the temperature of solid bodies with thermo-elements. **H. HAUSEN.** *Arch. Warmewirt. 8, 87-9(1927).*—Expts. showed that the error arising from the conduction of heat along the couple depends on the cond. of the solid tested, on the depth of immersion, and on the temp. difference between air and object. Thus with cork and a temp. difference of 115° an immersion of 17 cm. is required to reduce the error to 0.1° with silk-insulated Cu-constantan wires 0.06 cm. thick.

ERNEST W. THIELE

The refractive index of alkali boron fluorides. A lecture demonstration. **J. H. DE BOER.** *Physica 7, 99-101(1927).*—Because the refractive index of alkali boron fluorides is near to that of water and their dispersion curves are different, color effects appear in mixts. of these salts with their satd. solns. Ten g KBF₄ boiled in 100 cc. water is transparent blue at 100°, green at 90°, yellow at 60°. In a concd. HBF₄ soln. of KBF₄ these phenomena appear at room temp.

B. J. C. VAN DER HOEVEN

A photographic method of investigating the color of light sources, and the reflecting power of colored fabric and other surfaces. **P. W. CUNLIFFE AND F. D. FARROW.** *J. Textile Inst. 18, T291-302(1927).*

E. J. C.

The transparency of turbid media. **LUDWIG SILBERSTEIN.** *J. Opt. Soc. Am. 15, 125-30(1927).*—Mathematical.

E. J. C.

Ignition of natural gas-air mixtures by heated metal bars. **H. F. COWARD AND P. G. GUEST.** *J. Am. Chem. Soc. 49, 2479-86(1927).*—Measurements of the temps. at which metal bars ignite mixts. of natural gas and air show that the metals of greater catalytic effect must be hotter to cause ignition than metals or other substances of smaller catalytic effect. The temp. necessary to ignite the natural gas-air mixts. by bars of Ni, W and several special steels was found to increase regularly with increase in natural-gas content of the inflammable mixts. With two of the 3 Pt bars tested, a much higher temp. was required to ignite the most violently explosive mixts. than to ignite less explosive mixts.

LOUISE KELLEY

Arsine from fused glass. **H. M. ELSEY.** *Science 66, 300(1927).*—When borosilicate glasses were heated and stretched an odor of arsine was detected. The odor might be due to gaseous As. The odor was noticeable only when fresh free surface was being formed in glasses which contained 0.5% and 0.8% As. The source of the odor is most likely the reaction represented by $4As + 3H_2O \rightarrow As_2O_3 + 2AsH_3$. This reaction is similar to the reaction between P and H₂O at high temps. $4P_2 + 12H_2O \rightarrow 3H_3PO_4 + 5PH_3$.

F. F. BROWN

3—SUBATOMIC PHENOMENA AND RADIOCHEMISTRY

S. C. LIND

Earth's thermal history. **J. JOLY.** *Phil. Mag. [7], 4, 338-48(1927).*—Polemical. Discussion of Jeffrey's articles in *Geol. Mag.* 1926, 520; cf *C. A.* 20, 2450. G. G.

Developments of the new quantum mechanics. **P. JORDAN.** *Naturwissenschaften 15, 614-23, 636-49(1927).*—The matrix mechanics of Heisenberg, Born, Jordan, Dirac are developed and compared with the wave mechanics of Schrödinger, Einstein (Bose), deBroglie. A list of 58 references is appended.

B. J. C. VAN DER HOEVEN

Symmetry characteristics of terms for systems with equal particles in the quantum mechanics. **F. HUND.** *Z. Physik 43, 788-804(1927).*—The non-combining systems of terms for a given no. of equal particles are linked directly with the symmetry relations of the Schrödinger characteristic functions. In this way a new and simple derivation is obtained for all the results given by Wigner (*C. A.* 21, 3310) and also the possibility of writing the form of the characteristic function for the different term systems.

C. C. KIESS

An aspect of the history of atomism. **J. C. GREGORY.** *Science Progress 22, 293-*

304(1927).—A concise history of the at. theory of matter from ancient times to the present.

JOSEPH S. HEPBURN

Comparison between the dispersion formulas of the atomic theory and the theory of continuity. FR. HLÚČKA. *Sitzb. Akad. Wiss. Wien* 135, IIa, 9-28(1926).

S. C. LIND

A theory of matter and electricity. G. D. BIRKHOFF. *Proc. Natl. Acad. Sci.* 13, 160-5(1927).—Matter is supposed to be a charged fluid held together by an "atomic potential". For this fluid the pressure equals $\frac{1}{2}$ the d. By using the method of tensors and the principle of relativity and the assumption that two bits of the matter fluid of the same charge may not penetrate, while matter of the opposite sign may penetrate, B. derives the principle of conservation of energy and the possibility of a stable and determinate at. system.

F. R. BICHOWSKY

The hydrogen atom and the Balmer formula. GEORGE D. BIRKHOFF. *Proc. Natl. Acad. Sci.* 13, 165-9(1927); cf. preceding abstr.—The H atom is assumed to be a uniform and spherically symmetrical equiv. mixt. of positively and negatively charged fluids; the negative part has but little mass density. For such a system the elec. force will vanish at the boundary. The oscillations of such a system are of a general form which reduces to Schrödinger's in a special case.

F. R. BICHOWSKY

Transition probabilities for principal series of sodium from Schrödinger's wave functions. V. SUGIURA. *Phil. Mag.* [7], 4, 495-504(1927); cf. C. A. 18, 3533; 19, 2780, 2781; 20, 2618.

GEORGE GLOCKLER

Some considerations of the properties of element number 87, dicesium (Dc 224), and of the possible cause of the radioactivity of potassium and rubidium. D. DOBROSERDOV. *Ukrainskii Khim. Zhurnal* 1, 491-7(1925); *Chem. Zentr.* 1926, II, 162.—Dc should have an atomic vol. of 93-98, greater than that of any other element, and therefore should show the highest ionization capacity. The sensitivity of its detection by spectral means can accordingly be only slight. On the other hand its radioactivity should be high, and the radioactivity of K and Rb is probably explainable by their admixt. with Dc. Both α - and β -rays are probably emitted by Dc, the α -rays being, however, for the most part absorbed by the surrounding mass of K or Rb (whence the He content of K minerals), while the more penetrating β -rays give the appearance of a β activity of K. In searching for Dc, highly radioactive K prepns. should be utilized and efforts directed towards increasing this radioactivity by fractionation.

C. C. DAVIS

Coördinative binding and atomic structure. H. LESSHEIM, J. MEYER AND R. SAMUEL. *Z. anorg. allgem. Chem.* 165, 253-83(1927).—A comprehensive discussion of the nature of coördination linkage, which is regarded as essentially similar to homopolar linkage. It is distinguished from the latter in that instead of involving the electrons in the outermost incomplete groups it depends on those of the completed sub-groups next below, which become exposed after the removal of the valence electrons in the formation of an ion. The electrons of these completed sub-groups may then be shared with atoms, ions, and satd. or unsatd. atom groups to form coördination bonds. For the elements of at. nos. 23 to 30 the probable arrangement of electrons in various stages of ionization according to the quantum nos. n , k and j shows that the max. coördination no. is usually equal to the no. of electrons in the outermost completed sub-group. Certain rules are noted concerning the influence on the coördination no. of the no. of electrons in the incomplete sub-groups. These rules hold in similar transition elements of the other long periods wherever they can be applied. The theory is also extended to complex compds. of the lighter atoms. The magnetic properties of coördination compds. also agree with the theory.

F. A. JENKINS

The constitution of ordinary lead. F. W. ASTON. *Nature* 120, 224(1927).—The mass spectrum of ordinary lead (tetraethyl-lead used) consists of 3 principal lines, corresponding to at. wts. of 206 (relative intensity 4), 207(3) and 208(7). Indications of another isotope at 209 and possibly 203, 204 and 205 were found; the lines of the last three were, however, badly overlapped by the Hg spectrum. A seventh Hg isotope at 196 was found, occurring to an extent of 0.04%.

J. B. C. VAN DER HOEVEN

The electron affinity of hydrogen. G. JOOS AND G. F. HÜTTIG. *Z. Physik* 40, 331-2(1926); cf. C. A. 21, 2599.—The electron affinity of H atom is calcd. from grating energies based on the structure of NaH obtained from x-ray photographs. H is energetically stable and the electron affinity is between 15 and 35 Cal.

M. F.

Helium compound. D. H. MORRISON. *Nature* 120, 224(1927).—He and other gases at pressures from 0.5 to 1 mm. passed over a strong radioactive source of Ra B and Ra C, simultaneously excited by a silent elec. discharge, then through a U-tube with glasswool and into a bulb with ZnS screen, appeared to become radioactive (scintillation

count). The elec. excitation was essential for H_2 ; negative results were obtained for O_2 and N_2 . For He a positive result, less intensive than for H_2 , was obtained; it suggests the formation of a gaseous helide of Pb or Bi and is explained from the H_2 character of orthohelium.

B. J. C. VANDERHOEFEN

Structure of radioactive atom and origin of α -rays. E. RUTHERFORD. *Phil. Mag.* [7], 4, 580-605 (1927).—R. puts forward the view that the nucleus of a heavy atom has certain well-defined regions in its structure. At the center is the controlling charged nucleus of very small dimensions (not greater than 1×10^{-12} cm.) surrounded at a distance (about $1.5 - 6.0 \times 10^{-12}$ cm.) by a number of neutral satellites describing quantum orbits held in equil. by the polarizing action of the elec. field arising from the central nucleus. In the case of radioactive atoms these neutral satellites must consist in part of neutral He nuclei which lose their closely bound electrons when the elec. field falls below a certain crit. value. No definite information is so far available as to the number of these satellites or whether the satellites are all of the same kind. It seems not unlikely that neutral satellites of mass 2 or 3 and possibly 1 (neutrons) may exist in the strong elec. field of the nucleus. The central nucleus is thought to be a closely ordered and almost cryst. arrangement of its component electrons and protons and it may be that the number of such stable arrangements in nature is limited. If such be the case then several elements may have the same inner nucleus. For a radioactive series R assumes that this is the case. The energy of motion of a neutral particle having escaped its inner nucleus, is derived as also for a charged He nucleus. It is especially assumed that the corresponding electrons fall towards the inner nucleus (to satisfy the radioactive displacement law). The known velocities of alpha particles from radioactive elements are then used to derive a system of energy-levels within the nucleus in which levels these neutral satellites are supposed to move. The quantumnos. assigned to these levels vary from element to element and their numerical values extend from 14.5 to 30. Half quantum nos. are used. A relation between the radioactive decay const. λ and the above quantum no. n is found of the form $\log \lambda = c + \alpha n^{2.6}$, where c and α are factors for a particular radioactive series. This relation is similar to the well-known Geiger-Nuttall relation connecting range of α -particle and decay const. Emission of γ -rays: It has been thought so far that γ -ray emission is due to the falling of electrons from one energy level to another within the nucleus (C. A. 20, 867; 21, 3017; and W. Kuhn, *Z. Physik* 44, 32 (1927)). However, it is possible that γ -rays may also be caused by the dropping of satellites in various energy levels within the nucleus.

GEORGE GLOCKLER

A precise measurement of e/m_0 by Busch's method. FRITZ WOLF. *Ann. Physik* 83, 849-83 (1927).—A detailed account of B.'s original method as well as W.'s improvements thereon is given. A mean of 70 measurements of e/m_0 gives the value $(1.767 \pm 0.0018) \times 10^7$ e m u.

J. H. PERRY

The electron as a vector wave. C. G. DARWIN. *Proc. Roy. Soc. (London)* A116, 227-53 (1927).—An expansion of the conception already enunciated (C. A. 21, 1752) that difficulties in the interpretation of the spinning electron in terms of the wave theory may be met by considering the wave of an electron, like a wave of light, in terms of 2 components. The wave equations are fitted to the H spectrum, and thus conform to quantum mechanics. They are unsymmetrical, and therefore best interpreted in terms of a vector. Formulas are developed in vector form for the intensities of spectral lines, and for the magnetic moment of the atom, the theory being sketched for 2 or more electrons.

W. T. RICHARDS

Theory of paramagnetism. B. CARRERA. *J. phys. radium* 8, 257-75 (1927).—The Curie-Weiss law, $\chi(T + \Delta) = C$, is a definitely established empirical relation. The const. Δ may have either pos. or neg. values between wide and, as yet, undetd. limits. Its value for a given paramagnetic atom may be altered by changes in the structure and chem. nature of the compd. and these seem to be the predominant factors in detg. its value. This suggests that an alteration in the susceptibility of a dissolved cation, produced by a change in concn., may be due to imperceptible changes in the value of Δ caused by the formation of complex cations, rather than to the existence of two or more different states for the cation of which the relative proportion is altered by change in concn. The const. C is characteristic of the paramagnetic atom itself. Empirically $\sqrt{C} = nk$, where n is an integer and k is a universal const. This leads at once to the conception of the Weiss magneton. To obtain Langevin's formula by the application of quantum ideas, C. assumes that: (a) the electron configurations of the outer layers of the atom become "disorganized" whenever the atoms approach within a certain distance of each other; (b) the rearrangement of the electrons is effected in such a way as to conserve the magnetic moment; (c) in case an external magnetic

field exists, the probability of any particular orientation of the magnetic axis depends both upon the field and the influence of the neighboring atoms. The development of these ideas (worked out in collaboration with J. Palacios) leads to the Curie-Weiss law with the addition of a small factor $(1 - l^2)$, which is negligible in most cases, and which does not change the magnetic moments appreciably. The value of Δ computed from this theory fulfils all the conditions required by expt. As outlined, the theory implies that any deformation produced by the external field is a second-order effect, thus making paramagnetism independent of temp. W. W. STIFLER

Theory of paramagnetism. B. CABRERA. *Compt. rend.* **185**, 346-8(1927); cf. preceding abstract.—Empirically it is found that paramagnetic properties are associated with atoms having unsatd. electron shells, particularly the sub-levels M_{IV} and M_V in the Fe group, N_{IV} and N_V in the Pd group, O_{IV} and O_V in the Pt group, and N_{VI} and N_{VII} in the rare earths. The magnitude of the deformation produced in the electron configuration of an atom depends upon (a) the stability of the original configuration, (b) the distance between the atom and those that surround it, and (c) the nature of those atoms. Thermal agitation accounts for the variation of χ with temp. For monatomic gases, only the effects of the impacts need be considered, while for polyatomic gases, liquids and solids, the vibration of the atom about its equil. position must also be considered. W. W. STIFLER

The magnetic dispersion of electrons. W. BOTHE. *Z. Physik* **44**, 543-8(1927).—A mathematical paper in which it is shown that the magnetic moment of the electron should have a characteristic influence on the dispersion of cathode rays. W. W. S.

Molecular structure. H. LUDLOFF. *Naturwissenschaften* **15**, 409(1927).—Term analysis of the partial spectral bands has yielded considerable knowledge on the electronic structure of molecules. In agreement with Lewis it was found that electron impulses in mols. are so distributed that they neutralize each other in pairs. All "even" mols. are diamagnetic. This is further discussed in detail. A result of this rule is the red shading of the band spectrum of even mols., and violet shading for odd ones (cf. *C. A.* **21**, 2608). The explanation of this structural peculiarity lies in the symmetry of the proper electron function in the two-center problem for unequal nuclei.

B. J. C. VAN DER HORVEN

The probability law in radioactive radiation (measurements on polonium). WALTHER KUTZNER. *Z. Physik* **44**, 655-83(1927).—K. had previously observed (*C. A.* **18**, 1236) a systematic deviation from the theoretical probability distribution of α particles from a Po prepn. as the surface of the prepn. was made larger. This effect is confirmed in a more complete study, and possible alternative explanations given by others (recoil effects; insufficient resolving power of the counting app.) are shown to be incorrect. The origin of the effect is still obscure. F. A. JENKINS

Mode of disintegration of radium D, E and F. SEISHI KIKUCHI. *Japan. J. Physics* **4**, 143-58(1927).—A silk fiber, activated with a prepn. of Ra D, E and F in equil., was stretched across the cloud chamber of a Wilson condensation app. and the track of rays emerging from this line source were photographed. In some expts., a strong prepn. of these elements was brought near to the chamber, and the tracks of photoelectrons excited in the gas filling the chamber by a radiation of the γ -ray type were also obtained. On these photographs of Ra F α -rays, Ra E β -rays, Ra D β -rays and the photoelectrons could be unmistakably distinguished each from the others. No tracks were found in the form of pairs. A suggestion was given that Ra F probably undergoes a double disintegration. The heterogeneity shown by Ra E β -rays could not be ascribed to the effect of encounter with planetary electrons. Each atom of Ra E emits 1 and only 1 β -particle at disintegration. There was found a group of Ra D rays excited in the L levels by γ -rays other than those which have hitherto been known. The γ -rays here found were shown to consist of either a homogeneous radiation of wave length 4 A. U. or a more or less heterogeneous radiation having a max. of intensity distribution at that wave length. The coeff. of internal conversion of Ra D was found to be 0.95. The formula, $\tau = \beta Z^4 \lambda^3$, of the ordinary absorption was found to hold good also for internal conversion. C. J. WEST

Special effect of polonium, of solar radiation, and of high tension on lead. SR. MAKACINEANU. *Compt. rend.* **185**, 122-4(1927); cf. *C. A.* **20**, 3638.—Po deposited on Pb and subjected to solar radiation has been discussed in a previous note. At the suggestion of Deslandres the author has made use of 120,000 v. The Po was in a very weak HCl soln. The current of ionization given by the face opposed to the cell which carries the Po was measured. The expts. are classified in 4 series. Leaflets not exposed; leaflets exposed resp., to a high positive or negative voltage; leaflets exposed at the same time to the sun and the high voltage; leaflets exposed to solar radiation only.

Curves are given showing the ionization currents! All four cases show currents. The curves are divided into two distinct groups. Leaflets not exposed or exposed only to high voltage; leaflets exposed to solar action only or complemented by high voltage. The nature of the radiation developed on the face opposite the cell which carries the Po is α , which cannot come from the Po for it would be stopped by the 0.1 mm. Pb. A new radioactive substance developed in the Pb is suggested. L. D. R.

Remarks on the preceding communication. DESLANDRES. *Compt. rend.* **185**, 124-5(1927) -- Besides the α radiation the Po may give a little γ radiation. The α -rays are stopped by the lead; but they may give rise to a radiation of protons. The exact interpretation will require more research. L. D. R.

Pleochroic haloes in cordierite. G. MAHADEVAN. *Indian J. Physics* **1**, 445-56 (1927). -- Pleochroic haloes occurring in cordierite from South India are studied under the polarizing microscope. Embryonic rings, normal, "emanation," "over-exposed," "bleached" and "dwarf" haloes are met with in the sections examined. The radii of these haloes show close agreement with the calculated values for the α -range of the members of the U and Th series in the mineral. In many cases, the successive rings are well preserved. There is no more discrepancy between the expected and observed results in the haloes of cordierite than in those of biotite. MARIE FARNSWORTH

The radioactivity of water and mud of the lake of Tékir Ghoil. G. SIADBEL. *Ann. sci. univ. Jassy* **14**, 20-2; *Chem. Zentr.* **1926**, I, 2787. -- The lake contains dissolved H_2S , $NaCl$ and $MgSO_4$, and probably sepd. from the Black Sea, near which it is located. The radioactivity of the water is very slight, viz., about 7×10^{-16} g. of radioactive substances (Rn) per g. of water. The radioactivity of the mud is greater, and by the method of H. W. Schmidt showed about 0.163 millimicrocuries per l. of water. The opinion is held that the therapeutic action of the curative water cannot be attributed solely to its radioactive properties, but also depends upon its content of sol. salts and colloidal substances. C. C. DAVIS

The variation of radioactivity of hot springs. KATSUYOSHI SHIRATORI. *Science Repts. Tôhoku Imp. Univ.* **16**, 613-20(1927). -- S. studies the radioactivity of hot springs in the west of Honsyu to det. whether the earthquake of May, 1925 had any effect on their activity. His results show that the radioactivity of the hot springs is generally higher with a few exceptional cases. The temp. of the springs was generally lower. No causes for the changes in temp. and radioactivity were detd. D. H. POWERS

Uranium minerals from Lotsmanskaja Kamenka near Jekaterinoslaw and from Khutor Golowin near Shitomit and their radioactivity. N. LIESCHENKO. *Nachr. Berginstituts Jekaterinoslaw* **19**, 171-5; *Chem. Zentr.* **1926**, I, 2560. -- Both U minerals, of which the first could not be more closely defined, originate from pegmatites. The first one is attacked by mineral acids with evolution of gas. It is of lemon-yellow color and is highly radioactive, having 50% of the radioactivity of pitchblende. The second one, *wijkite*, varies from olive-brown to a dark brown, has a hardness of 5, gives a bright yellow streak and by microchem. examn. contains U, Th, Si, Fe and perhaps Cb. Its radioactivity is 60% that of U pitchblende. C. C. DAVIS

A method to measure minimal quantities of radon and its use to determine the radium content of some meteorites. GRETE HALLEDAUER. *Sitzb. Akad. Wiss. Wien* **134**, IIa, 39-44(1925). -- The essential differences from the method of Joly consist in the use of the radon chamber to measure the time of charging rather than discharging an electrometer. By having an identical chamber, the rate of natural discharge can be measured simultaneously with the principal detn. Five samples of meteoric iron gave the following results in 10^{-13} g. Ra per g. of material: Hex River Mts. 0.86; Mt. Joy 0.47; Nelson Co. 0.18; Cocks Co. 0.40; Roebourne (Hammersley Range) 0.84. Five samples of meteoric stone gave: Waconda 7.1; Tabory (Ochansk) 3.34-7.84; Moes 3.31; Dhurmsala 12.6; Beaver Creek, 4.7. Previous measurements agreed well with the new ones, though uniformly somewhat lower. S. C. LIND

The separation of pure radium salts from isomorphous mixtures with barium. A. G. ELISEEV. *Ann. inst. anal. phys. chem.* **3**, 443-54(1926). -- Soly. isotherm (at 25°) of $BaCl_2$ in water + HCl shows no complex formation, the soly. being 30.7 g. per 100 g. of H_2O and approaching 0 in 28% HCl . A study of the system $RaCl_2$ - $BaCl_2$ - HCl - H_2O shows that the soly. of $RaCl_2$ at first decreases more rapidly than that of $BaCl_2$; $RaCl_2$ does not influence the soly. of the Ba salt. The soln. was at no point satd. with respect to $RaCl_2$; the latter seps. by forming isomorphous crystals with $BaCl_2$. The enrichment factor is 2.8 at the beginning of pptn. with HCl and approaches 1 asymptotically. The Tyuyamuyun ore contains 1.49% U_3O_8 , 4.63% Ba and traces of rare earths. BASIL C. SOYENKOFF

Pyrex as a container for radium solution. L. F. CURTISS. *Nature* **120**, 406

(1927).—A Pyrex bulb contg. a large amt. of dissolved Ra salts was badly cracked after 2 yrs., the cracks occurred only above the level of the soln. A. E. RUARK

Actinium series and the order of stability of radioactive isotopes. A. S. RUSSELL. *Nature* 120, 402-3(1927).—R. assumes that (a) the Act series starts with an isotope of U, ends at an isotope of Pb, and includes uranium Y; (b) if an element of even at. no. has isotopes of odd at. mass, these are likely to be 1 and 3 units less than the mass of its most stable isotope; (c) the most stable mass* of an element of odd atomic no. is likely to be one unit greater than that of the most stable mass (of even no.) of the element next below it. The consequences of these postulates for the Act series are discussed, leading in some cases to the prediction of new at. wts. A. E. RUARK

The scattering of alpha particles by helium. E. RUTHERFORD AND J. CHADWICK. *Phil. Mag.* [7], 4, 605-20(1927); cf. *C. A.* 16, 678.—The collisions of α particles with He nuclei have been investigated. The results show that, in general, the collision relations for these particles are similar to those holding for the collisions between an α particle and a H nucleus. At large distances the forces between the particles are given by Coulomb's law, but at closer distances very strong additional forces come into action. Possible explanations of the origin of these additional forces are discussed, and it is suggested tentatively that they may be due to magnetic fields in the nuclei. GEORGE GLOCKLER

Effect of radon on solubility of lead uranate. K. C. BAILEY. *Phil. Mag.* [7], 4, 404-7(1927).—A. Holmes (*C. A.* 20, 2450) suggests that the difference existing between the estimates of geological time based on the Pb/Th ratio in Th minerals and those based on the Pb/U ratio in U minerals is due to the fact that, in the latter case, most of the Pb produced would probably form $PbUO_4$, which is practically insol. while in the former the relatively sol. $PbThO_3$ would be formed and partially removed by leaching. The fact that a compd. is insol. "in vitro" does not prove that the same compd. will be insol. when subjected to a radioactive field; and, although the field produced in the case of a U mineral is feeble as compared with that available in the laboratory, its action has probably continued over many millions of years—a fact which may well compensate for its lack of intensity. Moreover, such minerals usually contain traces of other compds. such as chlorides, which might interact with $PbUO_4$ under the influence of radiation to form sol. substances. $PbUO_4$, whether boiled for some hours with distilled H_2O or left in contact with distilled H_2O for several weeks, remained quite insoluble. The supernatant liquid gave no color with sodium sulfide, even when evaporated to one-tenth its volume with a few drops of nitric acid, to prevent the deposition of any lead which had gone into solution, and made alkaline before testing. Further, no Pb passed into soln. when $PbUO_4$ was boiled for some hours with a soln. of NaCl. However, when $PbUO_4$ is acted upon by Rn it becomes sol. as B. shows exptly. It is possible then as a result of these expts., that the Pb/U ratio in a U mineral is likely to be considerably affected by the entering into soln. of both Pb and U under the influence of the radioactive field due to the mineral itself. If it is assumed that a $PbUO_4$ is formed and under the influence of strong ionization is brought into soln. and removed, then equal numbers of atoms of U and Pb will disappear; and, as this involves a larger percentage reduction of the Pb than of the U present, it follows that estimates of geological time based upon the Pb/U ratio will err on the side of insufficiency. GEORGE GLOCKLER

Ionization produced by radon in spherical vessels. G. GLOCKLER. *J. Phys. Chem.* 31, 1322-31(1927). A comparison is made of the ionization produced by Rn and its decomposition products as calcd. by the av.-path law of Lind (*C. A.* 7, 1671) and by the method of Mund (*C. A.* 20, 3380). The two methods give similar results for small spherical vessels up to a diam. of 10 cm. as has been found previously by Lind by an exptl. method (*C. A.* 13, 1182). A new derivation of Mund's equation is given and the assumption made by Mund that all of the Ra A and Ra C decompose on the wall is modified. On the basis of the exptl. detn. of the av. path law by Lind and Bardwell (*C. A.* 18, 14) which gives the av. path equal to 0.61 times the radius of the reaction vessel, G. calcs. that 30% of the Ra A and 7% of Ra C decompose in the gas phase. Mund's efficiency factor has been recalcd. on this basis. GEORGE GLOCKLER

Tracks of α -particles in a thick silver bromide gelatin layer on a photograph plate. L. MYSSOVSKII AND P. TSCHISHOV. *Z. Physik* 44, 408-20(1927).—The tracks of α -rays were studied with the aid of photographic emulsions thicker than 50μ . While almost all of the tracks were straight, a very few showed deflection as great as 90° and some showed forks. These were taken stereoscopically and a continuous registration of α -rays was secured. F. O. A.

The β -rays of great velocity from radioactive substances. D.-K. YOVANOVITCH AND J. D'ESPINE. *J. phys. radium* 8, 276-83(1927).—The authors have studied the rapid

β -rays of several radioactive substances by the method of the magnetic spectrum. They have shown why direct deviation app., provided with numerous improvements, is found particularly favorable for this study. Rapid β rays have been detected for Ms Th 2, Th B, Ra B + C and Ra E. For each of these substances, the results obtained with the direct deviation app. have been compared with those found by other experimenters employing different methods. The elevated energy attained by certain of these rays (for example 8,000,000 volts for MsTh2) is of the same order as that for certain α -rays (those of Th C, which attain 8,825,000 v.) L. D. R.

The absorption of β -rays by matter. GEORGES FOURNIER. *Ann. phys.* **8**, 205-77(1927); cf. *C. A.* **20**, 3127.—This work correlates the researches that have been undertaken on the subject of absorption of β rays by matter. These researches, applied to β -rays of Ra E and to simple absorbing substances with at no below 50, give evidence of a simple relation: $\mu/\rho = 15 + 0.142 N$ between the mass coeff. of absorption and the at. no. N of the absorbing element. In trying to extend this law to the heavy elements, there appears a parasitic phenomenon imputable to secondary radiation. The results of the absorption of the β -rays of Ra E in compds. have been classified with relation to an additive law. Disturbance due to certain grouping of atoms has been noted. The linear law relative to simple substances holds for all groups of β -rays: $\mu/\rho = a + bN$. A general expression is given to the mass coeff. of absorption: $\mu/\rho = b(105 + N)$ in which the quality of β -rays is characterized by the coeff. b and the quality of the absorbing agent by its at. no. N . L. D. R.

The effect of the bombardment of lithium chloride by slow positive ions in a high vacuum. EUGEN BADAREU. *Physik. Z.* **28**, 634-7(1927).—In a very high vacuum the current flowing from a positive ion receiving plate to the ground is slightly less for a receptor consisting of an Fe plate covered with LiCl than for a bare Cu plate. Furthermore, the current comes to a max. value and remains stationary with increasing energy of the bombarding ions, with the LiCl receptor, while there seems to be no limiting current value when the receptor is a bare metal. In air at pressures of a few tenths of a mm. of Hg, the current flowing from the salt-covered plate is a very small fraction of that flowing from a bare Cu plate, B's expts. being in agreement with those of Völker (*C. A.* **13**, 3072). The cause of the difference in behavior in the 2 cases is supposed to be the difference of c. d. of the bombarding ions. At the higher pressure, the more intense stream of bombarding positive ions causes the salt to emit positive ions, the results being a decrease of current flowing from the receiving plate to the ground. Emission of positive ions from salts is smaller, the smaller the ion-current density which causes the emission. R. J. HAVIGHURST.

Physical and biological effects of high-frequency sound waves. R. W. WOOD AND A. L. LOOMIS. *Phil. Mag* [7], **4**, 417-36(1927).—Sound waves of high frequency were generated in an oil bath by a piezo-electric oscillator of quartz operated at 50,000 v. and vibrating 300,000 times a second. The oscillations were produced by vacuum tubes and the quartz plate controlled the frequency in the usual way. If the waves are passed across the boundaries sepg. two liquids such as oil and H₂O or Hg and H₂O more or less stable emulsions are formed. Chem. reactions are accelerated and crystns. are started. The most striking of the chem. effects is in the so-called "clock-reaction" in which the termination of the reaction is marked by the sudden change from a clear transparent soln. to a deep blue one. A layer of translucent paraffin formed small opaque spots (centers of crystn.) when acted on by the vibrations. Colloids of a "very difficult" soil sample were completely dispersed in a few minutes, while the usual methods of shaking violently and centrifuging would have to be repeated 20 or 30 times before the colloid is completely dispersed. Many physical and biol. effects are described. GEORGE GLOCKLER.

Influence of weak magnetic fields on the state of polarization of the light given out by hydrogen canal rays. H. RAUSCH V. TRAUBENBERG AND S. LEVY. *Z. Physik* **44**, 549-64(1927).—The state of polarization of the light emitted by H canal rays was studied for the H α and H β lines in fields from 1 to 80 gauss for various combinations of field and observation directions with the direction of the canal rays. (1) With direction of field coincident with line of observation, and both perpendicular to direction of rays, a rotation of the plane of polarization was observed. This increased with the field but at the same time a depolarization was observed. (2) With line of observation, field, and ray-direction mutually perpendicular, the depolarizing effect was observed without rotation of the plane of polarization. (3) When observed in the direction of the rays, there is no polarization without the field, but a transverse magnetic field produces polarization. (4) When field and rays are in the same direction, observations at right angles to this show no polarization effects. (5) The rotation and depolarizing

effects mentioned under (1) and (2) vanish when the canal rays have traveled a certain distance outside the field, and the original state of polarization gradually reappears. A mathematical discussion of these effects is included. W. W. STIFLER

The critical potentials of iodine. V. KONDRATIEV AND A. LEIPUNSKY. *Z. Physik* **44**, 708-12(1927).—An exptl. technic is developed for detg. the crit. potentials of an easily dissociated polyatomic gas. It permits the distinction between the crit. potentials of the mol. and those of the atoms. A bundle of mols. is collimated so that it passes between the gauzes of the ionization app. without coming in contact with the hot cathode, thus avoiding thermal dissocn. A subsequent expt. is made in which the mol. stream is partially dissociated by pre-heating. Additional crit. potentials in this measurement are then ascribed to the atom. By this method, I_2 gives crit. potentials at 2.5 and 3.8 v. The former is interpreted as due to the dissocn. of the mol. into one normal and one excited atom, the latter into two excited atoms. Prominent crit. potentials of the atom are found at 1 and 6.5 v. F. A. JENKINS

Ionization by collision and a photo-electric theory of the sparking potential. T. TAYLOR. *Phil. Mag.* [7], **4**, 505-11(1927).—Reply to Huxley, *C. A.* **21**, 2603. T. refutes Huxley's contention that photoelec. action at the cathode of discharge tubes cannot be a reasonable mechanism of production of electrons (cf. *C. A.* **21**, 1221, 1405). GEORGE GLOCKER

The emission of light from hydrogen atoms. R. D'E. ATKINSON. *Proc. Roy. Soc. (London)* **A116**, 81-103(1927).—Expts. are described in which a non-luminous beam of canal rays was made to emit the Balmer lines by excitation at one point only. The distribution of excitation round this point was determinable, and the position of its max. could be fixed within 0.02 mm. The distribution of intensity was detd. photographically and compared, near the max., with that to be expected on the assumption that the intensity due to a strict point-excitation would begin at the point and fall off exponentially. An agreement supporting this view was obtained. The nature of the excitation process, and further expts. made possible by the success of the method, are discussed. W. T. RICHARDS

The ionization process in hydrogen, nitrogen and argon. KARL E. DORSCH AND HARTMUT KALLMANN. *Z. Physik* **44**, 565-74(1927).—Expts. are described which give the following ionization processes in H_2 : Electrons of about 16 v. velocity form primary H_2^+ . Additional primary processes do not take place in appreciable amount (less than 0.5%) at least up to 40-50 v. There are 2 secondary processes: H_2^+ forms H_3^+ through reacting with neutral H_2 mols. and H_2^+ decomposes into H^+ and H atoms. The latter only takes place with the further addn. of a detd. amount of energy. The ionization potentials of H_2 , N_2 and A are compared with one another. Their order is as follows: A, N_2 , H_2 . If one gives to A an ionization potential of 15.6 v. (inferred from optical measurements) the value for N_2 is between 16 and 16.5 v. for H_2 about 16.5 v. MARIE FARNSWORTH

The ionization potential of terbium. L. ROLLA AND G. PICCARDI. *Atti accad. Lincei* [6], **5**, 818-9(1927).—With the flame method already used for other elements (cf. *C. A.* **20**, 2945) $\log K$ was found to 10.212 for Tb, compared with 13.403 for Na and 11.498 for Ca which were used as controls. The ionization potential of Tb was, therefore, 6.74 v., a value which falls exactly on the curve of ionization potentials of the rare earths (cf. *C. A.* **21**, 699). C. C. DAVIS

The critical potentials of nitrogen and the nature of active nitrogen. A. S. LEVSELEY. *Trans. Faraday Soc.* **23**, 552-60(1927).—The nature of the collisions between N mols. and electrons has been examd. over a range of electronic energy values extending from 2.0 v. to 15.0 v. It is shown that these collisions become inelastic at the point when the electrons attain 6.30 v. energy; further, starting from this point the collision would appear to be inelastic over a range of about 3 v. The effect of the addn. of H has been studied. This causes no modification in the results obtained, and it is concluded that the effect observed is due solely to N and not to any NO present in the gas as impurity. The inelastic collisions observed may be assocd. with the excitation of a band system of N, situated in the ultra-violet region of the spectrum and having for its final state the stable state of the mols. A. L. HENNE

The ionization potential of helium according to the Schrödinger theory. G. W. KELLNER. *Z. Physik* **44**, 91-109(1927); cf. *C. A.* **21**, 3309.—The sum of the 2 ionization potentials of He is detd. on Schrödinger's theory. As the result of 4 approximations the value 77.840 v. was obtained, giving 23.750 v. for the first ionization potential. A. E. RUARK

The lowest term of once-ionized lithium on the Schrödinger theory. G. W. KELL-

NER. *Z. Physik* **44**, 110-2(1927).—By the methods used in calcg. the ionization potentials of He (cf. preceding abstract), lower limits for other ionization potentials are obtained as follows: Li^+ , 73.88 v.; Be^{++} 151.29; B^{+++} 255.86; C^{++++} 387.73.

A. E. RUARK

Ionization in flames of various organic substances. J. A. J. BENNETT. *Trans. Faraday Soc.* **23**, 307-11(1927); cf. *C. A.* **21**, 1058.—An attempt to find a relation between the degree of ionization of org. compds. in flames and the amt. of detonation in engines burning fuels contg. them. To measure the ionization, 2 small Pt electrodes, kept a cm. apart, are placed in the flame, const. temp. being maintained at the anode by a Pt, Pt-Rh thermocouple. A p. d. of 30 v. is used between electrodes, the current through the flame being measured with a galvanometer. In introducing the compds. into the Bunsen flame the more volatile are mixed with the air used and the less are burned at the mouth of the burner. Org. N and halogen compds., carbonyls, org. oxides, halogens, aldehydes and other miscellaneous org. compds. are tried in this way; some increasing and others decreasing the cond. of the flame. Differences are caused by variations in the concn. of electrons, there being no catalytic action. Substances with low ionization potential increase the no. of electrons in the flame and, therefore, the current, while those with a high potential produce the opposite effect. The influence of these compds. on ionization in a hexane flame, produced by passing dried air through a bottle contg. cotton satd. with it and burned in 4 quartz tubes, so sealed in a rubber stopper as to produce a long flame, is found to be the same as in the Bunsen flame. Ionization in the substances themselves is detd., the less volatile liquids being vaporized by heating and then passing air over or through them. As they increase or decrease ionization in the Bunsen flame, so do their flames show greater or less elec. cond., resp. A mixt. of 2 substances produces a flame the cond. of which lies between the sep. conductivities of the 2. There is no simple relation between ionization and detonation, although both occur simultaneously in the flame; the former being neither a cause nor an effect of detonation, but a temp. effect.

J. BALOZIAN

Magnetic susceptibilities of the positive ions of vanadium. SIMON FREED. *J. Am. Chem. Soc.* **49**, 2456-68(1927).—The susceptibilities of V^{++++} , V^{+++} and V^{++} were measured by a new null method of which a description is given. The V^{++++} ion had 1 integral Bohr magneton, the V^{+++} ion 2 magnetons and the V^{++} ion 3 magnetons. A possible explanation is offered for the fact that these results do not agree with any current theory based on the anomalous Zeeman effect and quantum considerations. Measurements on some diamagnetic substances are included.

W. W. S.

Some tests on the electrodeless discharge in stationary waves. R. MOENS. *Bull. sci. acad. roy. Belg.* [5], **13**, 72-6(1927).—Ionization and luminosity phenomena produced by stationary elec. oscillations of high frequency in tubes contg. rarefied Ne, air, H_2 , O_2 , N_2 and Hg are described. The spectrum of the Hg discharge differs from that of the Hg arc in distribution of intensity of the lines. A Ne tube introduced through the axis of 2 coils placed end to end increases an induced e. m. f.

J. E. SNYDER

The transition of ordinary dispersion to Compton effect. IVAR WALLER. *Nature* **120**, 155-6(1927).—A preliminary account of work on a generalized dispersion formula which includes light waves with λ both large and small as compared with the dimensions of the dispersing or scattering body. The gradual transition from dispersion (λ large) following Kramers and Heisenberg's laws to Compton scattering following Breit and Dirac's laws for intensity is described qualitatively for an atom with one electron.

B. J. C. VAN DER HOEVEN

Deflection of molecular rays of electric dipolar molecules in the inhomogeneous electric field. ERWIN WREDE. *Z. Physik* **44**, 261-8(1927).—Mol. rays of KI, TlI, NaI, CsCl and RbBr were deflected in an inhomogeneous elec. field. From the magnitude of the deflection, the elec. moment for KI is of the order of 10^{-17} e.g.s. units, which agrees with theoretical values (*C. A.* **18**, 2837).

J. E. SNYDER

The work of thermionic emission. G. MICHEL. *Z. Physik* **44**, 403-7(1927).—A formula is set up and tested exptly. for the work of emission of electrons from a group of elements (or their oxides) as a function of the metallic atoms in the surface.

F. O. A.

Electronic theory of the voltaic cell. O. M. CORBINO. *Phil. Mag.* [7], **4**, 436-46(1927).—Discussion of contact potential of metals in relation to the seat of e. m. f. in voltaic cells (cf. *C. A.* **19**, 611; **21**, 2104, 3018).

GEORGE GLOCKLER

The dependence of the dielectric loss and the dielectric constant of paraffin, hexane, xylene, quartz, glass, porcelain, hard papers, pressboard and an ionized air condenser upon the frequency. ERNST MÖLLER. *Arch. Elektrotechn.* **15**, 16-40(1925); *Physik. Ber.* **6**, 1374.—A study of the dependence of the dielectric loss as detd. by the power

factor or phase-difference δ and the dielec. const. of the insulating materials on the frequency through the range 500,000–12,100,000 ω showed that they fell roughly into 3 groups which can be expressed mathematically as follows: (I) $tg\delta = a/\omega + b$ porcelain and moist pressboard; (II) $tg\delta = b + c\omega$; $tg\delta = b + c\omega^n$ hydrocarbons, SiO_2 , glass contg. heavy metals, some papers; (III) $tg\delta = \frac{1}{2}a/\omega + b + c\omega$ papers, "Fredener" glass, rich in alk., moist C_7H_8 and porcelain. The effect of moisture was evident only in hygroscopic pressboard and the liquid hydrocarbons hexane and C_7H_8 . a , b and n are consts. usually equal to 1. Since a power-loss in a condenser can be considered equiv. to a resistance, the expts. amount to a resistance measurement. E. R. SCHIERZ

Rotating-crystal x-ray photographs. GILBERT GREENWOOD. *Mineralog. Mag.* 21, 258–71 (1927).—The crystal is rotated in a beam of x-rays and the reflected rays are recorded photographically on a cylindrical film the axis of which coincides with the axis about which the crystal is rotated. This method is well adapted for the study of crystallographic problems such as the detn. of the true cell dimension in the direction of the axis of rotation and the space group in which the substance crystallizes. Rotation photographs were made of $N(CH_3)_4I$ and $N(C_2H_5)_4I$. W. F. HUNT

The direction of ejection of x-ray electrons. E. C. WATSON AND J. A. VAN DEN AKKER. *Proc. Natl. Acad. Sci.* 13, 659–62 (1927).—The method of obtaining magnetic spectra of the electrons ejected by x-rays has been used to study the velocity and number of electrons as a function of the angle of ejection. The most probable direction of ejection is at approx. 80° from the forward direction of the x-ray beam, and is the same for electrons from all energy levels. The momentum of the electron in its orbit does not affect the direction of ejection in the way demanded by the theory of Auger and Perrin (*C. A.* 21, 1754). This work presents a serious difficulty for the conception of the reality of electronic orbits. R. J. HAVIGHURST

Values of energy characteristic of the x-levels. A. CARRELLI. *Nuovo cimento* [N. S.], 3, 144–51 (1926).—An examn. of the exptl. material pertaining to the energy of the orbit of x-rays shows the admissibility of a quantum n coinciding with the theoretical value. The particular characteristic of the x-orbits depends upon the presence in them of all the electrons that can be accommodated. The lack of disturbing action on the part of other electrons is a further confirmation of the symmetrical distribution of all the orbits constituting a given stratum. L. T. FAIRHALL

Installation for the study of spectrography, crystallography, and metallography with the use of x-rays. L. ROLLA AND L. MAZZA. *Met. italiana* 18, 247–80 (1926).—Monograph describing the installation set up for these studies at the Univ. of Florence, and making use of the methods of Laue, Bragg, Siegbahn, Debye-Hull, etc. Numerous photographs and sketches are given, and also the mathematics and details of the methods. ROBERT S. POSMONTIER

The rotating-crystal method. E. SCHIEBOLD. *Fortschritte Mineral. Krist. Petr.* 11, 113–280 (1927).—A very complete and detailed account is given of the x-ray rotating- and oscillating-crystal methods of studying crystal structure, with descriptions of the app. and mode of interpreting photographs. A long bibliography is included. J. F. SCHAIERER

Researches on quartz. A. MEISSNER. *Physik. Z.* 28, 621–5 (1927); cf. *C. A.* 21, 361. —If a quartz plate cut perpendicular to one of the 3 elec. axes is excited by high-frequency vibrations of variable frequency, 2 longitudinal vibrations of the plate occur. One mode of vibration appears when the exciting frequency corresponds to a wave length of 1665 m., the other at 1160 m. These longitudinal vibrations are inclined at angles of 71° and 48° to the optical axis. X-ray crystal analysis indicates that planes of Si atoms are inclined to the optical axis at approx. these same angles. The p. d. induced between faces of a quartz plate by pressure was measured with a string electrometer and with a double-grid vacuum tube. Elastic properties may be calcd. approx. from the data of the elec. acoustic excitation. R. J. HAVIGHURST

The atomic structure of the antimony oxides. U. DEHLINGER AND R. GLOCKER. *Z. anorg. allgem. Chem.* 165, 41–5 (1927).—An x-ray study has been made of the 4 oxides, Sb_2O_3 , Sb_2O_4 , Sb_6O_{13} and Sb_2O_5 , by the Debye method, from which the following conclusions are drawn. All 4 oxides have cubic lattices—pseudo cubic in the case of Sb_6O_{13} . The lattice of Sb_2O_3 corresponds to the structure of senarmontite described in the literature. All the lines in the Debye photograph of Sb_2O_4 are derived from those of Sb_2O_3 , if the sine of the angular refraction is multiplied by 1.082. Moreover, the intensity of the corresponding lines of the two films is the same except for slight differences in three lines. The photograph of Sb_6O_{13} shows all the lines of Sb_2O_4 in the same position and intensity and, in addition, a few very weak new lines. There is no difference in position and intensity in the lines for Sb_2O_4 and Sb_2O_5 . From exposures with a

chamber of specially high resolving power it follows that the lattice constns. of Sb_2O_4 , Sb_2O_5 , and Sb_2O_3 are the same within at least 0.1%. From these facts diagrams of the lattices of the oxides are deduced. They are cubic structures and the cubes of Sb_2O_4 and Sb_2O_3 develop from the simple structure of Sb_2O_5 by the addition of further planes. Sb_2O_5 cannot be represented by a cubic lattice and this is in agreement with the observation that this is the only one of the oxides to show double refraction. The deviation from a cubic structure is, however, very slight. The structure is tetragonal, built up of three cubic cells, the axial ratio being 3.

A. W. KENNEY

Globe and spherical scale utilized for the determination of the orientation of crystals by x-rays. USABURO YOSHIDA. *Japn. J. Phys.* **4**, 133-6(1927).—A method of using a globe and a spherical scale in the researches of crystals by x-rays is described.

C. J. WEST

Higher multiplets in x-ray spectra. J. H. VAN DER TUUK. *Z. Physik* **44**, 737-44 (1927).—A new study of the M x-ray line in the region of the rare earths shows that M_α and M_β lines of these elements exhibit very important structure and intensity anomalies. The complex doublet $M_{\alpha 1\alpha 2\beta}$ degenerates for these elements into an only partially resolved multiplet, whose structure changes from element to element. These deviations from the usual doublet character are brought into relation with the completion of the 4-quantum electron groups in the rare earths.

F. A. JENKINS

The azimuthal intensity distribution in scattered x-rays. W. FRIEDRICH AND G. GOLDBABER. *Z. Physik* **44**, 700-7(1927).—Using an ionization method, measurements are made of the intensity distribution of the scattered radiation produced by hard x-rays (200,000 v, 2 mm Cu filter). The comparison of the exptl distribution with various theories shows a relatively good agreement with that of Compton.

F. A. JENKINS

Intensity measurements of x-ray reflections from fine powders. J. BRENTANO. *Phil. Mag.* [7], **4**, 620-9(1927); cf. *C. A.* **16**, 1182; **20**, 2786.—An investigation is made of the intensity of x-ray reflections of very fine powders of NaCl. The intensities were evaluated by photometric measurements made on the powder photographs of NaCl which had been obtained with the type of camera designed by B. The principal difficulty in the way of obtaining reliable data is due to the existence of extinction both primary and secondary in the crystal. In the present work the conditions of extinction of x-ray reflections from extremely fine powders are discussed, and it is pointed out that the only extinction effect which can occur is const. for all reflections, but is a function of the wave length. The conditions which have to be satisfied in order to make relative intensity measurements from powders independent of the knowledge of the coeff. of absorption and of extinction are indicated. The method adopted for the evaluation of the photographic records of NaCl is described. The results are compared with other detns. employing single crystals and relatively coarse powders. The measurements are in general in good agreement, but for the most powerful reflections the present measurements give somewhat higher values, indicating a small amount of primary extinction in the measurements from larger crystals. Reducing a crystal to the state of a "coarse" powder can in general be considered suitable for eliminating secondary, but not primary extinction.

GEORGE GLOCKLER

Determining the crystal orientation of metallic single crystals. YOSOMATSU SHIMIZU. *Science Repts. Tohoku Imp Univ* **16**, 621-5(1927).—Since the detn. of the crystal orientation of metallic single crystals by means of x-rays is troublesome, S. has devised a method for making the same detns. very simply. The etched surface is brought in front of an elec. lamp and placed in the orientation in which it appears most shining, the position of the eye being fixed. A thin cover glass is fixed on the etched surface at such an angle that the image of the lamp is superimposed on the brightest part in the etched surface. The surface of the cover glass must then be parallel to the microfaces in the metal face, so if the angle is measured between the cover glass and the etched surface the inclination of the microfaces against the plane etched surface is detd.

D. H. POWERS

X-ray diffraction in liquids. C. M. SOGANI. *Indian J. Physics* **1**, 357-92(1927).—Previous exptl. work in this field is summarized and it is shown that the available data are rather meager and not sufficiently precise. A review is made of the theories so far proposed, and in particular, of the theory of Raman and Ramanathan which extends the thermodynamic theory of light-scattering to the x-ray region. Improvements in technic are described: the usual glass or celluloid containers which give liquid-like patterns themselves, have been replaced by a cell with mica windows and the incident pencil used has been made narrower. By thus avoiding the complications due to the container and also getting a better resolution of the phenomenon, the variations in the

diffuseness of the halo and differences in its structure for different liquids are clearly revealed. Twenty-two liquids belonging to the aliphatic and aromatic groups have been studied: pentane, hexane, cyclohexane, heptane, octane, oleic acid, ether, glycerol, water, benzene, phenol, aniline, toluene, ethylbenzene, nitrobenzene, *o*-xylene, *m*-xylene, *p*-xylene, mesitylene, *o*-nitrotoluene, *m*-nitrotoluene and *p*-nitrotoluene. It is shown that the agreement obtained in a few cases by Keesom and Smedt between Ehrenfest's formula and the mean mol. distance as calcd. on the assumption of hexagonal closest packing is purely accidental. That the assumption of close-packing is not justified is shown by the data for the long-chain aliphatic compounds. The ratio k which the distance between the diffracting planes given by Bragg's law for the principal halo bears to the quantity $n^{-1/2}$, where n is the number of mols. per unit vol., has been calcd. for several liquids, and it is found that the value of k departs more and more from that corresponding to close packing as the length of asymmetry of the mol. increases. The influence of compressibility on the sharpness of the halo predicted by the theory of Raman and Ramanathan is confirmed: sharper halos are obtained with compounds of low compressibility. The scattering at small angles is not negligibly small, and is relatively greater in the case of liquids with higher compressibility or having comparatively unsymmetrical mols. than for the others. A study of over a dozen benzene derivs. shows an interesting variety in the structure of the principal halo. In *o*- and *m*-nitrotoluenes, and in mesitylene, the halo appears clearly resolved into 2 components. The progressive way in which the halo is modified as one passes to more and more complex derivs. and the distinct differences found even between the patterns of isomeric mols., reveals the importance in x-ray liquid-diffraction of the form and structure of the mols. M. F.

Some new regularities in atomic spectra. J. C. McLENNAN and A. B. McLAY. *Phil. Mag.* [7], 4, 407-12 (1927).—When the resonance frequencies for B, C, N, O, F and Ne are plotted against at. no. a curve with a break between N and O is found. Similar curves with similar breaks in an analogous position are obtained for the next 3 similar rows of elements in the periodic system. A possible interpretation is that the outer electron orbits in these elements fall into 2 subgroups contg. 3 electrons each, which arrangement differs from Stoner's classification into 2 subgroups containing 2 and 4 electrons, resp. (cf. C. A. 19, 209). GEORGE GLOCKLER

Action of x-rays on colloids. J. A. CROWTHER and J. A. V. FAIRBROTHER. *Phil. Mag.* [7], 4, 325-35 (1927).—It is shown that certain colloidal solns. are affected by exposure to large quantities of x-radiation. Positively charged colloids are coagulated by irradiation, but negatively charged colloids have their stability increased. The effect is studied numerically for a Bredig Cu sol. It is suggested that the coagulation is brought about by the ionization produced in the diffuse double layer surrounding the particles. GEORGE GLOCKLER

Spectral relationships of lines arising from the atoms of the first row of the periodic table. R. A. MILLIKAN and I. S. BOWEN. *Phil. Mag.* [7], 4, 561-89 (1927).—A summary of the various spectra of stripped atoms as obtained by M. and B. by hot-spark-spectroscopy is given together with a discussion of energy levels of these atoms and a complete graph of the Moseley law for these atoms. All the ionization potentials for removal of the first electron are now known: Li = 5.37, Be = 9.50, B = 8.34, C = 11.3, N = 14.49, O = 13.57, F = 16.9, Ne = 21.48 v. Some of the ionization potentials for removal of the second, third and fourth electron are also given. Modern spectroscopic theory as applied in the analysis of these spectra is discussed. G. G.

The ultra-violet absorption of crystals of simple structure. RUDOLF HILSCH. *Z. Physik* 44, 421-30 (1927).—The transparency of single alkali halide crystals to ultra-violet light was studied. The heavy-metal impurities which reduce the light transmission may be removed with $(\text{NH}_4)_2\text{S}$, giving a well-defined material for alk. halide phosphors. F. O. A.

The transition probability in the lithium atom. B. TRUMPY. *Z. Physik* 44, 575-84 (1927).—The results are given of a study of the intensity and breadth of the principal absorption series of Li. The jump probability for the Li atom is detd. through planimetering the absorption curve and the total intensity (a_M) of the lines calcd. M. F.

Theory of the isotope effect in line spectra. GEORGE JOOS. *Ann. Physik* 83, 1054-64 (1927).—The influence of the nuclear mass on the term values for heavier atoms is calcd. by assuming a system consisting of nucleus, electron core, and emitting electron. The mass effect with penetrating orbits may become several times as large as that calcd. for H-like atoms, provided the core dimension is not appreciably influenced. Previous statements that the H value represents an upper limit for the isotope effect in heavier atoms are therefore incorrect. With non-penetrating orbits, the effect can be only slightly larger or smaller than the H value. The equations give the proper order of

magnitude for the doubling found in the Ne lines by Hansen (*C. A.* 21, 1407), indicating that it is due to mass effects only, and does not involve differences in nuclear structure.

F. A. JENKINS

The character of the general, or continuous spectrum radiation. WM. DUANE. *Proc. Natl. Acad. Sci.* 13, 662-70(1927).—Expts. were made upon the general x-radiation produced by single impacts of electrons upon Hg vapor in order to obtain evidence bearing upon the following fundamental questions: First, when an electron hits an atom in such a way as to produce radiation other than that of the atom's line spectrum, does it produce a monochromatic ray? Second, when an electron produces general radiation, does it give up its entire kinetic energy to that radiation? The effective wave length of the radiation produced by electrons bombarding Hg vapor at a potential of 11,890 v. was found by an absorption method to be 1.10 Å. U., 6% larger than the short wave-length limit. In a large number of impacts, at least, the electron transfers almost if not all of its kinetic energy to the quantum of radiation when it produces that quantum, and the radiation thus produced is nearly if not exactly monochromatic.

R. J. HAUGHURST

Band spectra. R. C. JOHNSON. *Science Progress* 22, 231-53(1927).—A comprehensive review of the band theory and its relation to mol. structure.

J. S. H.

The structure of the atmospheric absorption bands of oxygen. G. H. DIEKE AND HAROLD D. BABCOCK. *Proc. Natl. Acad. Sci.* 13, 670 8(1927).

R. J. H.

The influence of the thermal agitation of crystal atoms upon the intensity, position, and sharpness of x-ray spectral lines. IVAR WALLER. *Ann. Physik* 83, 153-83 (1927).—A mathematical treatment of the effects of thermal motion of the crystal atoms upon x-ray spectral lines is given. Reference must be made to the original paper for details.

R. I. HERSHEY

Spectrographic investigations on carbohydrates in the ultra-violet. I. KWIECINSKI AND L. MARCHLEWSKI. *Z. physiol. Chem.* 169, 300(1927).—The absorption band in the ultra-violet observed by Niederhoff (*C. A.* 21, 1932) with galactose and glucose could not be confirmed except with preps. that had not been sufficiently purified. With fructose the purer the prepn. the feebler was the absorption band. Very pure preps. may be spoiled by further crystn. and the intensity of the absorption thus increased.

A. W. DOX

Instantaneous spectrograms of copper, silver and gold. HANTARO NAGAOKA, DAIZO NUKIYAMA AND TETSUGORO FUTAGAMI. *Proc. Imp. Acad. (Japan)* 3, 319-23 (1927). **Instantaneous spectrograms of zinc, cadmium and mercury.** *Ibid* 324-9. **Instantaneous spectrograms of boron, aluminum and thallium.** *Ibid* 330-3. **Instantaneous spectrograms of carbon, silicon, tin, lead and cerium.** *Ibid* 392-7. **Instantaneous spectrograms of antimony, bismuth and manganese.** *Ibid* 398-402. **Instantaneous spectrograms of chromium, molybdenum and tellurium.** *Ibid* 403-8. **Instantaneous spectrograms of iron, cobalt and nickel.** *Ibid* 409-14. **Instantaneous spectrograms of palladium, iridium and platinum.** *Ibid* 415-8.—The lines are given with their intensity, emission interval and phase. Full details will be published in the *Sci. Papers of the Inst. of Phys. and Chem. Res.* and general conclusions drawn.

C. J. WEST

Infra-red absorption spectra of organic sulfur compounds. I. Aliphatic mercaptans and sulfides. F. K. BELL. *Ber.* 60B, 1749-56(1927).—The infra-red absorption spectra between 1.0 μ and 12.0 μ of propyl, butyl and isoamyl mercaptans, as well as the corresponding sulfides, have been investigated. Four sharply defined absorption bands, which were present in the spectra of all these mercaptans, undergo a similar displacement toward the larger wave lengths during the transition of these mercaptans to the corresponding sulfides. The occurrence of a well-defined band at 3.8 μ in the absorption spectra of the 3 mercaptans, which is missing in the corresponding sulfides, offers the possibility of a qual. method of differentiating between the aliphatic mercaptans and sulfides.

J. H. PERRY

Series in the spectrum of trebly-ionized tin (Sn, IV). K. R. RAO. *Proc. Phys. Soc. London* 39, 408-16(1927).—Wave lengths in the spectrum of trebly ionized Sn (Sn IV) have been detd. from spectrograms obtained in the second order of a concave grating. These lines, following clues already given (*C. A.* 21, 1758), have been classified as members of principal (P), sharp (S), diffuse (D), fundamental (F), and super-fundamental (G), series. The details of the analysis including term values are given in the tables.

C. C. KIESS

Regularities in the spectrum of ionized neon. P. K. KICHLU. *Proc. Roy. Soc. (London)* 39, 424-8(1927).—Approx. 100 lines of the quartet system of Ne II have been classified as combinations between S', P, P', D, D' and F' terms (*C. A.* 21, 2226). The

lowest term so far found is $^1P'$ characterized by the seps. 518.0 and 298.8 cm^{-1} .

Infra-red absorption spectra of liquids. E. N. GAPON. *Z. Physik* **44**, 600-2 (1927).—It is shown that the wave nos. of the observed absorption bands of many liquids are represented by the formula $\nu_i = \nu_c \sqrt[n]{n}$, where n is an integer. The least wave no. of the series $\nu_c = 0.34 \times 10^{12} (V^{1/3}/M\beta)^{1/2}$, in which V is the mol. vol., β is the coeff. of compressibility, and M is the product of the mol. mass by Avogadro's no. A table contains a comparison of the observed and calcd. values of ν_c for 9 org. compds.

Rainbow "spectra." ROBERT SAXON. *Chemistry & Industry* **46**, 825-6 (1927).—Convergent light impinging on a vertical test tube filled with H_2O is reflected and dispersed after reaching the convex surface of the H_2O . The spectrum is called a "rainbow spectrum." If the H_2O is colored with various salts the spectra show characteristic absorption bands.

Determination of radiation factors of solid bodies. VIKTOR POLAK. *Z. tech. Physik* **8**, 307-12 (1927).—Data on emission coeffs. of technical materials are scarce and mostly in the range up to 300° . The factor σ_x of total radiation can be measured bolometrically from $\sigma_x = C\alpha_x/(T_{1x}^4 - T_2^4)$ for C an instrument const., σ_x the galvanometer reading, T_{1x} the surface temp. of the solid, T_2 the temp. of the surroundings. A bolometer according to Schmidt was used. The radiant body was a disk 4 to 5 mm. thick and 30 to 40 mm. in diam., bedded in fireproof insulation. It was heated up to 1200° with a $\text{H}_2\text{-O}_2$ jet flame. From expts. on black-body radiation C was evaluated. The following approx. values were detd. for bricks, silica brick from open-hearth gas chamber, rough surface, 1000° , $\sigma_x = 4.0$ Cal. per sq. m. hour and degree⁴, i. e., 80% of black-body radiation; silica brick from open-hearth arch, rough surface, slagged, 1100° , $\sigma_x = 4.28$, 85%; fireclay brick, glazed, 1000° , 3.7, 75%. For metallic surfaces was found: iron plate (4 mm.), smooth surface, 1035° , 2.97, 60%, at 900° , 2.80, 55%; steel plate (5 mm.), ground surface, at 1100° , 3.04, 61%, at 940° , 2.81, 55%; wrought iron, rough surface, at 1118° , 4.85, 95%, at 1045° , 4.58, 92%, at 925° , 4.31, 87%; cast-steel, ground, at 1040° , 2.80, 56%, at 900° , 2.70, 54%, at 770° , 2.60, 52%; cast iron, lathed surface, at 985° , 3.40, 70%, at 880° , 3.10, 60%. The great influence of the surface conditions is apparent. Oxide layers on metals raise the radiation considerably. From the metal values the Maxwell law of proportionality between absorptive power and electric resistance was confirmed.

Intensity of prohibited multiplets. L. S. ORNSTEIN AND H. C. BURGER. *Naturwissenschaften* **15**, 670-1 (1927).—Several p-f lines of the Cd arc spectrum between metal electrodes were measured. The ratio of p₀-f, p₁-f, p₂-f was found to be 1:3:5; the same holds for the second multiplet. An electrodeless discharge in pure Cd vapor of low pressure yielded no p-f lines; it appeared that the ratio p-f:p-d is a pressure function, approximately proportional to $p^{0.4}$. This ratio increases with the c. d., the lines widening for stronger fields. At atm. pressure p-f:p-d = 0.01 for the first multiplet, 0.10 for the second. The ten fold value of the latter is characteristic for Cd.

The zero-zero band of the second positive band spectrum of nitrogen. ($\lambda 371$). GISEBURO NAKAMURA. *Japn. J. Phys.* **4**, 109-17 (1927).—An arc in N emits strongly higher members of band lines of the 2nd positive band spectrum of N. An accurate wave-length detn. of the lines of the 0-0 band was made and it was found that the simple parabolic formulas of the Deslandres type obtained by Zeil and Lewis were not applicable to such high members. The fully recognized triplets of both P- and R-branches at lower quantum states were transformed into apparent doublets as the quantum no. was increased.

Interpretation of the continuous spectrum of hydrogen. YUTAKA TAKAHASHI. *Japn. J. Phys.* **4**, 103-8 (1927).—T. explains the continuous spectrum of H as emitted by a combination of 2 H atoms, of which at least 1 is excited. In the case of a combination of a normal atom and an excited one, it is shown that the spectrum should cover a region between 700 and 1200 A. U., if the final state is a normal mol. and a region extending from about 1800 A. U. to the infra-red, if the final state is an excited mol. If the 2 combining atoms are both excited to the final state of Balmer's series and the final state of the combination is an excited mol., the spectrum is shown to extend from 900 to 2000 A. U., where, according to Lyman and others, an intense continuous spectrum was actually observed when the c. d. in a discharge tube was great.

Spectra of various metals emitted from arcs in chlorine atmosphere. MICHIOKA MIYANISHI. *Japn. J. Phys.* **4**, 119-31 (1927).—Lines of Hg, Cd, Zn, Mg, Ca, Sr and Ba

emitted from 11-amp. arcs burned in a Cl atm. were examd. Many forbidden lines and enhanced lines were detected in these light sources. Besides these, many new lines were detected. Some of them are arc lines and their wave nos. are expressed as differences of known spectral term values. The remaining lines are spark lines; they are classified according to the method given by Kimura and Nakamura. In the expt. the current flowing in the arcs was always kept at 11 amps. But when the current in an ordinary arc in air was raised to about 45 amps., the spectrum became similar to that of 11-amp. arc in Cl. The essential cause of the forbidden lines and notable broadening of series lines, as well as the appearance of the enhanced lines observed in the present expt., may be ascribed to the presence of Cl ions in the arcking medium. C. J. WEST

The detection of hafnium by x-ray spectroscopy. K. KIMURA. *Z. physik. Chem.* **128**, 369-93(1927).—Using the $L\beta_1$ line of Hf and the $L\beta_2$ line of Cp_2O_3 , which are about 4 X-units apart, K. detd. percentages of Hf in mixts. of the oxides of Hf and Zr, and mixts. of their phosphates. The Hf contents of alvite, hagatalite and oyamalite were also detd. A. F. RUARK

The structure and stability of the carbon arc in relation to its ultra-violet output. H. D. GRIFFITH, J. S. TAYLOR and JESSIE M. JACK. *Brit. J. Radiology* (Roentgen Soc. Section) **23**, 203-14(1927).—The flame of the C arc contributes most of the biologically effective radiation. The efficiency of the arc as a source increases with flame length to a limiting value, after which it is independent of it. The ultra-violet emission can be considered as a function of the watts consumed in the flame of the arc. Conditions governing the max. possible flame length for an arc running under given conditions are worked out for one single arc and for a group of several in series.

Intensity relations in doublets of large frequency difference. I. S. ORNSTEIN, M. COELINGH and J. G. EYMERS. *Z. Physik* **44**, 653-4(1927).—The intensity distribution in several ps and pd multiplets of the Ba spark spectrum is measured. The summation rule is found to hold within exptl. error if the observed intensities are divided by the 4th power of the emitted frequency, as would be expected from the correspondence principle. F. A. JENKINS

The molecular diffusion of light in liquids. Experimental control of theoretical formulas. JEAN CABANNES. *J. phys. radium* **8**, 321-35(1927).—The exptl. results are first discussed in order to control afterward the theoretical formulas. The relation between the luminous intensity diffused laterally by 1 cc. and the lighting of the liquid is valued at 9.2×10^{-6} cm.⁻¹ for ether (20° C. and 4358 Å. U.) and $(10.7 \pm 0.55) \times 10^{-6}$ cm.⁻¹ for benzene (25° C. and 5440 Å. U.). The values are concordant. The relation of Ramanathan between polarization of light by vapor and depolarization by liquid (relation which supposes rigid mols.) is not verified in the fatty series. It is thought that the mols. with open chains are deformed in the liquid state and that this deformation diminishes their anisotropic properties. L. D. R.

Arc spectra of elements of oxygen group. J. C. McLENNAN, A. B. McLAY and J. H. McLEOD. *Phil. Mag.* [7], **4**, 486-95(1927).—The spectra of Se I and Te I are similar to O I and S I. All four spectra are shown to conform to the theoretical structures predicted for them by modern spectroscopic theory (Pauli-Heisenberg-Hund). The structure for Po I is not yet known as only a very few wave lengths that belong to its arc spectrum have been observed. GEORGE GLOCKLER

Optical excitation of mercury with controlled radiating states and forbidden lines. R. W. WOOD. *Phil. Mag.* [7], **4**, 466-86(1927); cf. *C. A.* **19**, 776; **20**, 17.—A further study of the various lines excited optically in Hg vapor with and without the presence of inert gases such as N₂, He, CO and A at various pressures. The abnormal increase in intensity of 2655.13 caused by admission of He contg. a trace of N₂ is found to be due to the development of the forbidden line 2655.8 (1S - 2p₂). The intensity ratios of the lines emitted as a result of optical excitation depend upon a number of factors such as: (1) the manner in which electrons on an upper level distribute themselves among lower levels, (2) the relative intensities of the lines in the exciting arc by the absorption of which the electrons are carried to upper levels, (3) transfer of electrons to metastable orbits, as by N₂, causing absorption of lines not normally absorbed, (4) an as yet unexplained action of N₂ in causing the appearance of lines not called for by the energy diagram (collisions of the second kind or sensitized fluorescence), (5) the intensity of the exciting light. GEORGE GLOCKLER

Molecular scattering of light in a binary liquid mixture. C. V. RAMAN. *Phil. Mag.* [7], **4**, 447-8(1927).—R. claims that K. C. Kar's criticism (*C. A.* **21**, 1906) is based on a misconception. GEORGE GLOCKLER

The heat of formation of the K₂ molecule. A. CARRELLI and PETER PRINGSHEIM. *Z. Physik* **44**, 643-52(1927).—The brightness of the red band-fluorescence excited in

K vapor by white light is measured, and is assumed to be proportional to the concn. of K_2 mols. From the latter the vapor pressure curve of K_2 is detd. and, combining this with the known heat of vaporization of at. K, the heat of formation of K_2 is found to be 0.63 v. It may also be calcd. directly from the results of expts. where the temp. is varied at const. pressure. By this method the value 0.53 v. is obtained. The convergence frequency of the band spectrum gives 0.63 v. F. A. JENKINS

Stability of acetone toward light. KARL WIESLER. *Z. angew. Chem.* **40**, 1033-4 (1927).—Chemically pure acetone which is stable toward permanganate soln. (Specification German Pharm. VI), after exposure to ultra-violet light will no longer pass this specification. After rectification of the acetone exposed to ultra-violet light, a pure acetone is obtained of higher permanganate stability, while the forerunnings and the residual fraction contain impurities unstable toward the permanganate. This shows that acetone initially satisfactory may develop unstable impurities due to photochem. changes of the acetone. Acetone should be protected from light, therefore, to maintain its permanganate stability. FREDERICK H. HAHN

The nature of the activating radiation in photochemical action. WILFRID TAYLOR AND ARTHUR ELLIOT. *Trans. Faraday Soc.* **23**, 583-92 (1927).—Actinic extinction curves have been obtained by allowing light filtered through various concns. of Cl to activate a mixt. of I and Cl. The activating radiation is shown to be non-homogeneous, and it is shown that the exptl. results can be accounted for to a high degree of approximation by assuming that the effective photochem. equiv. of monochromatic light is independent of wave length between 3500 and 6000 Å. U., and that for a given frequency the actinic power is directly proportional to the intensity. No evidence is found for assuming that any part of the ordinary optical absorption in this region has special chem. properties, or that 2 different types of absorptions, actinic and non-actinic, are superposed. A. L. HENNE

The photochemical decomposition of hydrogen peroxide solutions. F. O. RICE AND M. L. KILPATRICK. *J. Phys. Chem.* **31**, 1507-10 (1927).—Solns. of H_2O_2 in dust-contg. and in dust-free water decompose at very different rates. The rate of decompn. is roughly proportional to the dust content. By removing portions of the dust, solns. were obtained which decompd. from $1/3$ to some value less than $1/18$ as fast as the control or dust-contg. solus. Therefore it is to be expected that quant. measurements of the rate of decompn. of dust-free solns. of H_2O_2 , absorbing known amts. of light energy, would show that this reaction deviates much less from the law of photochem. equiv. than appears from the work of other investigators (*C. A.* **7**, 2344, 3445; **16**, 385). E. R. SMITH

Studies in photosensitization. I. J. R. BATES AND H. S. TAYLOR. *J. Am. Chem. Soc.* **49**, 2438-56 (1927).—A new type of *cooled mercury arc*, capable of operating at 100° , and a *high-pressure H discharge* giving a continuous ultra-violet spectrum (2500-1900 Å. U.) suitable for the study of absorption spectra by short exposures, are described. The following reactions have been studied: (1) Ethylene condenses under the influence of excited Hg atoms, but not by the action of light alone. (2) Acetylene is polymerized both by excited Hg atoms and by ultra-violet light, but cannot be hydrogenated by H activated by excited Hg vapor. (3) In the Hg photosensitized reaction between H and O, H_2O_2 may, under certain conditions, be the sole product. (4) H_2O , NH_3 , C_2H_6 , EtOH, MeOH, C_6H_6 , C_6H_{14} , HCOOH, acetone and ethylamine are decompd. by excited Hg atoms. (5) The decompn. products of NH_3 show an excess of H over stoichiometric proportions. The absorption spectrum of NH_3 has been studied. (6) Excited Hg atoms can decompose a HCO_2H mol. in 2 ways. The mechanisms of these reactions are discussed. W. T. RICHARDS

The measurement of light absorption. H. VON HALBAN AND J. EISENBRAND. *Proc. Roy. Soc. (London)* **A116**, 153-62 (1927).—A critical survey of the photographic and photoelec. methods for the detn. of light absorption. The conclusion is reached that "by employing a sufficiently large extinction the photographic method permits the extinction coeff. to be detd. to within a small percentage error." It is not suitable for small differences between extinctions, the photoelec. method giving, under favorable conditions, a sensitivity to differences of extinction about 10^3 beyond that of the photographic. W. T. RICHARDS

The luminescence of solid nitrogen under cathode-ray bombardment. J. C. McLENNAN, H. J. C. IRETON AND K. THOMSON. *Proc. Roy. Soc. (London)* **A116**, 1-15 (1927).—The phosphorescent spectrum of the light from solidified N, after irradiation by high-speed electrons from a Coolidge tube, consists of two bands, N_3 and N_4 . N_4 has components from 5240 to 5204 Å. U., 5214 having the strongest intensity. N_3 has components from 5944.47 to 5932.0 Å. U., the strongest being 5944.47. In addn. 3 diffuse bands N_1 having mean wave lengths of 5554, 5617 and 5658 Å. U.

and a number of faint diffuse bands, each shaded off towards the red in the blue and violet spectral region were observed. Highly red-sensitized plates failed to record the N_2 group reported by Vegard. The N_1 group bands faded under prolonged irradiation, but the N_2 and N_4 groups were unaffected, this being accounted for by a change in form of the solid nitrogen. The moment of inertia of the mol. system involved in the phosphorescence is calcd. as approx. 3×10^{-40} m.² cm.² These data, and other work at hand, make a decision concerning the existence of solid nitrogen in the upper atm. unwise, but it is the opinion of the authors that Vegard's hypothesis is untenable, and that "in seeking for the origin of the famous green auroral line we must turn to oxygen."

W. T. RICHARDS

The question of the occurrence of solid nitrogen in the earth's atmosphere. HEINZ PELZER. *Ann. Physik* **83**, 362-84 (1927).—An inquiry into Vegard's Aurora hypothesis. P. seeks conditions whereby the upper atm. layers, in radiation equil. with the sun's and the earth's rays, may attain temps. below 36° K. (m. p. of N). For such a condition to exist on the night side of the earth, the lower atm. layers must absorb the earth's radiation almost completely or at least selectively in the infra-red region to at least 99.5%. Such conditions are most improbable and it hence appears that Vegard's aurora hypothesis must be rejected on thermodynamic grounds. R. E. GIBSON

The luminescence of quinine sulfate. A. PETRIKALN. *Z. Physik* **42**, 435-42 (1927).—Quinine sulfate is luminous while being dehydrated. In an app. with a slowly revolving disk the quinine sulfate placed on the disk was dehydrated and rehydrated during one revolution; by this arrangement it was possible to direct the luminescence to the same spot for 12 hrs. The luminescence spectrum was photographed and analyzed; it consists of two large bands on the underground of which 9 small (20-30 A. U.) bands were measured between 4330 and 3580 A. U. These could be arranged in series. The energy transformation during dehydration is discussed. J. A. SZILARD

Spectral photography of faintly luminous phenomena. WILHELM KRAEMER. *Z. wiss. Phot.* **24**, 220-3; *Chem. Zentr.* **1926**, 11, 1506-7.—Light phenomena which are produced by Tesla oscillations and by the electroscope coated inside with tinfoil in satd. vapors of aniline, dimethylaniline, 1-naphthylamine, *o*-phenetidine, tetralin and naphthalene were studied. The lines and bands which were observed are compiled in tables. The emissions are attributed to definite atoms and atomic groupings. C. C. DAVIS

Absorption and fluorescence of the vapors of silver bromide and silver chloride. J. FRANCK AND H. KUHN. *Z. Physik* **44**, 607-14 (1927).—An investigation similar to that previously reported for AgI (*C. A.* **21**, 3024) is carried out on the absorption and fluorescence of AgBr and AgCl vapors. The absorption bands lie between 3100 and 3400 A. U. for AgBr and between 3100 and 3300 for AgCl. All bands have sharp heads shaded towards the red. The vibration frequency changes only slightly between the initial and final electronic states, the difference decreasing from iodide to chloride. Series of resonance lines were also obtained by suitable illumination of the vapors, of which 12 terms are measured for AgBr and 5 for AgCl. From these the heat of dissociation of AgBr is roughly estd. as 2.5 v., in agreement with the thermochem. value 2.6. This shows conclusively that in the vapor state these mols. are non-polar. The true heats of dissociation are closely related to the consts. of the quasi-elastic binding forces obtained from the vibration frequency in the normal state. It is therefore concluded that the electron linkage is of a similar type in the 3 mols. AgI, AgBr and AgCl. F. A. JENKINS

Phenomena of luminescence in the course of oxidizing reactions in aqueous solutions. LUCIEN MALLET. *Compt. rend.* **185**, 352-4 (1927).—Numerous oxidizing reactions are accompanied by the production, either of visible light, or of light detectable by the photographic plate and fluorescent substances. The type $\text{ClONa} + \text{H}_2\text{O} + \text{HCl} + \text{NaOH} + \text{O}$ is accompanied always by the production of light. In order to detect emission in the ultra-violet, fluorescent solns. capable of absorbing ultra-violet light and emitting in the visible were used. L. D. R.

Nature of activated molecules. L. J. WALDBAUER AND I. J. PATTON. *J. Phys. Chem.* **31**, 1433-4 (1927).—A simple explanation of the existence of active mols. can be obtained without recourse to any hypothesis of radiation. In the Bohr atom the electrons move in elliptical orbits with the nucleus at one focus. Their velocity is greatest near the nucleus and least in the outer portion of the ellipse. The valence electrons are furthest from the nucleus and are therefore, less firmly held throughout their journey; but at the outer limits of their orbits they are at their slowest speed. Collisions between mols. in this state will be almost certain to cause reaction and such mols. can be called activated. This does not exclude absorption of radiation quanta as an

auxiliary influence but its effects will merely move the valence electron further from the nucleus and consequently increase the activation somewhat. Like the radiation hypothesis this explanation of the activated mol. is not yet susceptible to exptl. or mathematical demonstration.

HARRY B. WEISER

The resonating power of some metallic salts in solutions irradiated by filtered light from a mercury arc. A. ANDANT AND E. ROUSSEAU. *Compt. rend.* **185**, 202-3 (1927).—The phenomenon of resonance previously obtained with Mn salt irradiated with filtered light from a Hg arc is not an isolated fact, since the same phenomenon has now been observed with salts of Mg, Na, K and U.

E. P. WIGHTMAN

Photovoltaic cells. C. W. TUCKER. *J. Phys. Chem.* **31**, 1357-80 (1927).—A detailed study of photovoltaic cells of the type (1) Illuminated Pt. MX | Soln. | Pt. MX or (2) Illuminated M-MX | Soln. | M-MX, where M is Ag or Cu, MX, Ag halide or Cu₂O (photosensitive substance) and the solns. are either reducing, neutral or oxidizing. In cells of the first type illumination causes oxidation of the photosensitive substance if the soln. is an oxidizing one and reduction if the soln. is a reducing one. The e. m. f. varies in sign accordingly. In cells of the second type illumination tends to promote reduction of the photosensitive substance. Here, however, local action causes reduction of the observed e. m. f. This is not great if the photosensitive substance is in a uniform layer but is very considerable where the layer is not uniform. A reversal in sign of the e. m. f. is the result unless the local cells formed are reversible. A theoretical discussion is essayed and the field is reviewed at length.

R. E. GIBSON

Optical dissociation of salt molecules. A. TEREIN. *Z. Physik* **44**, 713-36 (1927).—Irradiation of dil. vapors of diatomic halogen salts (e. g., NaI, TlBr, TII) with ultra-violet light of frequency greater than a certain limit causes a strong emission of several lines of the metallic atom. From the study of the dependence of this light on the wave length of the exciting radiation, on the presence of added gases, etc., this phenomenon is explained as a primary disocn. of the salt mol by the absorption of light, the products being an excited metal atom and a normal halogen atom. Irradiation of the dil. vapor of a triatomic halogen salt (e. g., HgCl₂, HgBr₂, HgI₂, CdI₂, ZnI₂, PbI₂) with ultra-violet light whose frequency lies between detd. limits gives an intense emission of an extended band system. Its features are wholly independent of the exciting frequency. The absence of an emission in the region of the exciting wave length, combined with the behavior of the phenomenon at higher pressures and with energy considerations, point to a primary dissociation caused by light in which the triatomic mol. yields an excited diatomic mol. and a normal (or excited) halogen atom.

F. A. JENKINS

Synthesis of *o*-nitrocinnamic acid and the photochemical behavior of this acid (ATANASESCU) 10. Concentrating deposits of radioactive emanations or similar active material (U. S. pat. 1,644,350) 17.

ATANASSIEVITCH, XENIA: *L'Atomisme d'Epicure*. Paris: Les Presses Universitaires de France. 111 pp. Reviewed in *Nature* **120**, 150-1 (1927).

Increasing radioactivity. A. GASCHLER. U. S. 1,644,370, Oct. 4. In order to increase the radioactivity of substances such as U and Th, they are heated under pressure and subjected to a high-potential elec. current.

4—ELECTROCHEMISTRY

COLIN G. FINK

Recent developments in electric steel furnaces. The new S. & H. high-efficiency arc furnace. R. GROSS. *Z. Ver. deut. Ing.* **71**, 1098-1100 (1927).—3 illus. In the new Siemens and Halske furnaces graphite electrodes are used in preference to carbon on account of the five-fold elec. conductivity and the consequent smaller cross section necessary to carry the current. A water-cooled circular sand trough is loosely fitted to each of the 3 electrodes directly outside of the roof to which it is luted. Above this trough a water-cooled Cu collar [to which the power cables are connected] is tightly fitted to each of the 3 electrodes. The collars are 35 cm. high, the lower outer edge being flanged and buried into the sand of the trough. Thus an almost gas-tight seal is obtained, resulting in a saving of about 20% in electrodes. At Remscheid the new furnace is of 8-ton capacity; it is used on special automobile steels; operates at 1700 k.v. a. 101 v. and at 3000 k.v.a. 175 v. Operating data: four charges per 24 hr. day at 580-

630-kw. hrs. per ton of finished steel, starting with cold charges; 8-10 charges per day at 180-220 kw. hrs. per ton of finished steel, starting with molten charge. An improved regulator automatically controls the feed of the electrodes. C. G. F.

High-frequency induction melting. D. F. CAMPBELL. *J. Iron Steel Inst.* (advance copy), No. 1, 9 pp. (Sept. 15, 1927).—A detailed review covering the Rodenhauer, Ajax-Northrup and other furnaces. C. G. F.

The automatic electric furnace. Its uses and possibilities. H. F. WOOD. *Trans. Am. Soc. Steel Treating* 11, 975-85(1927).—A description of two rotary-hearth elec. heat-treating furnaces for crank shaft production at the Ingalls-Shepard Company, Harvey, Ill. W. A. MUDGE

Electric annealing furnace is controlled automatically. EDWIN BREMER. *Foundry* 55, 674-7(1927).—The furnace is of 350-kw. capacity. Steel castings are heated to 1650° F. and this temp. is maintained for 10 hrs. Temp. is automatically controlled. Sand is used as a seal for the doors and the scaling is thus reduced to a min. [No details are given as to heating units, etc.] C. G. F.

Electric annealing solves machining problems at Timken plant. ANON. *Elec. World* 90, 729-30(1927).—A recent installation is Ni-Cr alloy resistor furnace of 850-kw. capacity, annealing 80 tons of steel bars at one charge. The furnace is of the pit type with an inside width of 9 ft., length 21 ft., depth from bottom piers to parting line of 6½ ft. C. G. F.

Behavior of molybdenum as resistor in the electric furnace. H. J. MILLER AND M. LINDERMAN. *Ann. Inst. Min. Met. Eng., Tech. Publ.* 16, 13 pp (1927).—The destruction of Mo ribbons used as resistors in elec. furnaces is due chiefly to chem. reaction with materials present in heating tubing, insulation, or gases in the furnace. Of these materials most likely to be there, SiO₂ and C are the most destructive. For the best working conditions of such furnaces it is recommended that both heating tubing and insulation should be of calcined pure alumina, mixed with Al(OH)₃ as binder and fired at 1500°. The first heating of a new furnace should be carried out under high H pressure which may be later reduced. If the material used for heating tubing or insulation contains C oxides of a high degree of oxidation should be added, so that they may react with it, the products of the reaction to be removed by evacuation. The molybdenum ribbon may be coated with molybdenum oxides having a low degree of oxidation to protect it from forming oxides or carbides. C. G. F.

Industrial heating control. P. H. CLARK. *Gen. Elec. Rev.* 30, 446-52(1927).—C. describes the mechanical type nonindicating temp. control instrument for elec. furnaces and ovens for use in low temp. work, and also the expansion type, which function according to the pressure exerted against a Bourdon spring through the medium of either a liquid, vapor, gas or mercury. These are, resp., limited to temps. of 150°, 400° and 1000° F. The gas-filled instrument is mostly used because it is more sensitive and has a greater temp. range. For temp. above 800° F. an elec. pyrometer or potentiometer is used. Various features of control panels, overload relays and temp. limit fuses are presented and the importance of accurate temp. control in various heating zones is emphasized with specific examples. A. D. S.

The formation of formaldehyde from water gas in the electric glow discharge. ADOLF KOENIG AND R. WEINIG. *Festschrift 100-jahr Bestehen Techn. Hochschule zu Karlsruhe* 1925, 525-30; *Chem. Zentr.* 1926, II, 2131. The treatment of mixts. of CO and H by the glow current leads to gaseous, liquid and solid products of varying compn., among which H₂O, CO₂, HCO₂H, HCHO and glycolaldehyde were identified (cf. Loeb, *Z. Elektrochem.* 12, 282(1906)). In attempts to det. the optimum conditions for HCHO formation, it was proved that with a current of gas, the products are adsorbed and adhere to the walls, as a result of electrophoresis. To avoid their enrichment with undesirable reaction products, the walls of the Siemens tube were continuously or periodically rinsed with water. In this way it became possible to obtain HCHO as the chief product of the action of the glow discharge on water gas, so that up to 77% of the gas treated was recovered as HCHO. The max. yield of HCHO was obtained when the incoming gas contained 46% CO by vol. Calcd. on a basis of the elec. energy consumed, the yield was 2 g. of HCHO per kw. hr. C. C. DAVIS

The commercial production of fluorine. P. LEBEAU. *Bull. soc. encour.* 139, 15-35(1927); cf. C. A. 20, 873—A general discussion and review. C. G. F.

The alkali-chlorine industry. JEAN BILLITER. *Z. Elektrochem. angew. physik. Chem.* 33, 353-60(1927).—This industry consumes 0.1% to 0.15% of total German industrial power. B. reviews construction of different electrolytic cells, electrodes, diaphragms, methods of operation, etc. The most widely used cells are the Siemens-Billiter, the Griesheim, the Hargreaves-Bird (in the Townsend, Nelson and Allen-

Moore modifications) and the Solvay. Newer uses for Cl are found in substitution and addn. products of acetylene to give solvents (e. g., trichloroethylene); org. compds. (e. g., phosgene, chlorobenzene, benzyl chloride and chloropiricin); metallic chlorides (e. g., ZnCl_2 , CuCl_2 , CuCl , etc.); and cellulose production (Italian process). D. G.

Pure caustic potash from technical potash by electrolysis using the mercury cathode. L. A. VERNITZ. *Trans. Russian Inst. for Appl. Chem.* No. 4, 10-16(1925).—V. describes (1) an app. for the electrolysis of a potash soln. (from wood and plant ashes) and the production of a Hg amalgam and (2) an electrolyzer for the decompn. of the amalgam into KOH and Hg. Drawings of the app. are given. J. S. JOFFE

Electrolytic preparation of sodium perborate at Larderello. UMBERTO SBORGI AND DAVID LENZI. *Giorn. chim. ind. applicata* 8, 423-7(1926).—Sketches and photographs of the app. used, and description of the process, are given. R. S. P.

The treatment of complex raw-speiss. W. F. KAISER. *Continental Met. Chem. Eng.* 2, 195-8, 238-42(1927).—K. reviews the constitution of speiss and wet and dry processes of treatment and then describes some electrolytic expts. The use of alk. sulfide soln. as electrolyte results in removal of As and Sb, and small quantities of FeS when present. H_2SO_4 was the acid electrolyte employed. Attention is called to the influences of certain metals during electrolysis, amperage, voltage, temps., lyes, regulation of liquor concn. and distance of the electrodes. The behavior of the single metals in the speiss is discussed. The expts. were made with similar materials in the anodes as used with basic electrolytes. The electrolyte was a 10% soln. of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ with 7% free H_2SO_4 . The expts. show the operation with raw speiss by direct hydrolysis is not economical, but when such raw speiss is concd. to a higher degree direct electrolysis is permissible, if Cu, Ni, Co and some As are the main metal constituents. Further experimentation is planned. W. H. BOYNTON

Progress in chromium plating. W. PFANHAUSER. *Chem.-Ztg.* 51, 605-6(1927).—In order to eliminate the occluded or codeposited H from Cr plate the von Bosse process submits the plated ware to high-tension a. c. *in vacuo*. A luminous discharge takes place from the surface of the plate and practically all H is removed after 15 min. at ordinary temp. C. G. F.

Electroplating. W. BLUM. *Ind. Eng. Chem.* 19, 1111-3(1927).—An address. Emphasis is laid upon the contributions of chemistry to electroplating. C. G. F.

The conductivity of plating solutions. II. A. E. NICOL. *Metal Ind.* (London) 30, 68-9(1927); cf. C. A. 21, 2437.—The influences of carbonate content in cyanide plating solns. are discussed and the necessity of a CO_3 content in excess of the total of the other constituents is an abs. necessity. An explanation of and method of testing for "layering" are given. W. H. BOYNTON

Formation of powdered copper in anode mud. M. DEK. THOMPSON. *Chem. Met. Eng.* 33, 298(1926).—T. explains why the reaction $2\text{Cu}^+ = \text{Cu} + \text{Cu}^{++}$ with finely divided Cu in the anode mud goes from left to right. Cu ions must be produced and not used up by diln. There is a slightly higher temp. in the immediate vicinity of the anode than in the main body of the soln. The reaction takes place as a result of cooling from the temp. of the junction of the anode and the soln. to the temp. of the body of the electrolyte. The effect of temp. fall must overpower the opposite effect due to diln. The same explanation as regards direction of reaction holds for the reaction $3\text{Au}^+ = 2\text{Au} + \text{Au}^{+++}$. W. H. BOYNTON

The formation of copper powder at the anode, and the passivity of the anodes. ERNESTO DENINA. *Ann. chim. applicata* 17, 284-96(1927).—Though Thompson is correct in showing that deposition of Cu at the anode is not solely a result of diln. (cf. preceding abstr.), his method of explaining the phenomenon by a temp. differential does not cover adequately the complicated phenomena involved. It is even possible that diln. accounts in part for the formation of Cu. A detailed discussion, based on phys.-chem. principles and mathematical reasoning, in which the mechanism of the process is explained, leads to the conclusion that the ratio of the no. of Cu^+ ions to Cu^{++} ions formed diminishes with increase in the c. d. This explains the favorable influence of a high c. d. in minimizing the loss of Cu in the anode sludge. C. C. D.

Electromotive utilization of the oxidation of solid and of liquid fuels. FRANZ FISCHER AND WALTER KRÖNIG. *Abhandl. Kenntnis Kohle* 7, 213-24(1925); *Chem. Zentr.* 1926, II, 1620.—The p. d. which appears during the oxidation of solid and of liquid fuels under pressure was investigated, the fuels being used for the cathode, Fe netting for the anode and aq. Na_2CO_3 for the electrolyte. The tension increased with increase of temp. The best results were obtained with solid fuels, while with brown coal and crude petroleum, reducing substances (humic acids) entered the soln. and greatly reduced the effect. The chief difficulty lies in the construction of a suitable

app. In conclusion, the electromotive utilization of the auto-oxidation of solid fuels was investigated. C. C. DAVIS

Automotive storage battery. W. L. REINHARDT. *Ind. Eng. Chem.* **19**, 1124-6 (1927).—A non-technical discussion from the standpoint of construction and standardization of materials. C. J. BROCKMAN

The mercurous sulfate electrode for testing storage batteries. SAKABE MAKIO. *Trans. Am. Electrochem. Soc.* **53** (preprint), 6 pp. (1927).—See *C. A.* **20**, 3648. C. G. F.

Electrolysis of mains by stray currents from tramway system. (Corrosion.) M. H. SARRADE. *Gas J.* **179**, 449-51 (1927).—Given in a well installed street railway system as much as 12 to 20% and in old systems as much as 60% of the return current may find its way to neighboring pipes and cause much damage. Photographs of typical cases are given, and remedies are suggested. R. W. RYAN

A study of the phenomena of electrolytic corrosion of mains. A. BOLZINGER. *Gas J.* **179**, 499-501, 551-3, 628-9, 754-6 (1927).—The theory of electrolytic corrosion is discussed and distinguished from ordinary soil corrosion, and equations are developed for potential at any given point. The direct protection of underground mains by coatings, etc., is extremely costly and uncertain in effectiveness. All return feeders on trolley lines should be maintained at equal potentials. Methods of measuring p. d. and intensity of current are given, especially the methods using tri-electrode vacuum tubes as described by Chappuis. The production of graphic charts is discussed. R. W. RYAN

The corrosion of lead cable sheaths due to stray currents. O. HAEHNEL. *Elek. Nachr. Tech.* **4**, 106-15 (1927); cf. *C. A.* **20**, 2649.—An address. The voltmeter test alone is not sufficient to establish the presence or absence of corrosion. The chem. compn. of the corrosion products is much more reliable. PbSO_4 , PbCl_2 , $\text{Pb}(\text{NO}_3)_2$ and PbO_2 have all been found when corrosion was due to stray currents. The first 3 are present in but small quantity when corrosion is not due to stray currents. If the railway track from which the stray elec. current emanates is more than 100 m. distant, the effect is practically nil. Clean Fe electrode *versus* clean Pb electrode buried in the soil and in the absence of air gave a potential of -0.1 v., Pb being the anode. With the introduction of air the polarity is reversed, rising to almost $+0.3$ v., Pb now being the cathode. C. G. F.

Recording overvoltages with the Clydonograph. MÜLLER-HILLEBRAND. *Siemens-Z.* **7**, 605-12 (1927).—Nineteen illustrations. C. G. F.

Mercury-arc-rectifier characteristics. E. B. SHAND. *Elec. J.* **24**, 486-93 (1927). C. G. F.

Dielectric* puncture under oil. J. T. LITTLETON AND W. W. SHAVER. *Elec. World* **90**, 503-5 (1927).—Expts. on Pyrex glass and porcelain show that the breakdown is not instantaneous. No evidence was obtained of the breakdown being caused by heating. Further work is being done. C. G. F.

Gas films in high-tension cables. L. EMANUELI. *Elec. World* **90**, 601-5 (1927).—Tests show that bombardment of insulating compd. by gaseous ions causes air emulsions and forces a path through impregnated paper fiber which leads eventually to dielec. breakdown. C. G. F.

Hot-cathode rectifier using a thoriated molybdenum cathode. A. GEHRTS. *Siemens-Z.* **7**, 559-64 (1927). C. G. F.

The effect of series resistance on the current from a photoactive cell containing a fluorescent electrolyte. C. C. MURDOCK AND DOROTHY WAUGH MURDOCK. *Trans. Faraday Soc.* **23**, 593-600 (1927); cf. *C. A.* **20**, 3644.—Current is generated by illumination of a Goldman cell. The reciprocal of the current in 10^{-10} amps. is plotted against the external resistance in megohms. The result can be expressed by the equation: $1/i = S(r + R)$, in which i is the current, r the resistance of the circuit, S the slope of the exptl. curves and R its negative x -intercept diminished by the resistance of the shunt galvanometer and that of the cell. This correction is in most cases much less than the uncertainty of the value of R . From the above equation, one obtains for the total e. m. f. of the circuit: $ri = (1/S) - Ri$. Consequently, the e. m. f. of the circuit comprises a part measured by $1/S$ which is independent of the current and a negative part, $-Ri$, proportional to the current. A. L. HENNE

Direct production of steel from minerals (CATANI) 9. The reduction of alumina and other oxides by W at high temperatures (WARTENBERG, MORHL) 6. Electronic theory of the voltaic cell (CORBINO) 3. Photovoltaic cells (TUCKER) 3. A new method

for the evaporation of electrolytic caustic (BADGER) 18. Forming refractory linings for electric furnaces (U. S. pat. 1,643,425) 19.

FERRIER, R.: *Quelques idées sur l'électro-dynamique*. Paris: Alb. Blanchard. 48 pp.; 5 francs. Reviewed in *Rev. métal.* 24, 555(1927).

Electric battery. A. HEIL. Brit. 262,814, Dec. 10, 1925. The positive plates may be made of a Cr alloy such as Cr-Ni or Cr-Co, or of C impregnated with paraffin and the electrolyte may be dil. H_2SO_4 to which may be added a depolarizing salt such as $NaNO_3$ or $K_2Cr_2O_7$. Zn plates form the negative electrodes and various structural features are specified.

Electric battery. L. DARIMONT. Brit. 263,081, Dec. 19, 1925. In a battery as described in Brit. 241,729 (C. A. 20, 3397) having a porous cell with semi-permeable membranes on the inner and outer faces, a salt of an alkali metal such as NaCl is added to the depolarizing soln. in order that it may diffuse into the space between the membranes and increase the cond. there. Tartaric acid also may be added, and $FeCl_3$ may be used as depolarizer. Cf. C. A. 21, 1231.

Primary electric battery. M. L. MARTUS. U. S. 1,644,344, Oct. 4. A sepg. material for use in primary cells (with a Cu oxide cathode, Zn anode and caustic alkali electrolyte) is prepd. by treating cellulose (which may be in the form of wood) with a 40° B \acute{e} soln. of Na zincate.

Primary electric battery. M. L. MARTUS and E. H. BECKER. U. S. 1,644,389, Oct. 4. In making cells of the Zn-Cu oxide type, a paper sleeve is impregnated with Na zincate soln., treated with alkali silicate soln. and then sprinkled, while still wet with a thin layer of Zn dust; the paper is then placed in the battery with its metallized surface in contact with the Cu oxide.

Primary cell. SVENSKA ACKUMULATOR AKTIEBOLAGET JUNGNER. Swed. 62,674, March 29, 1927. The electrolyte is a soln. of an alkali metal hydroxide in a concn. equal to or below the concn. of max. soly. of the hydroxide of the anode metal, in order that the concn. of the electrolyte shall remain practically unchanged during the discharge.

Dry cell battery. K. H. W. RAMSAY. U. S. 1,644,746, Oct. 11. Dry cell bobbins have a surface coating of an inherently permable varnish which may be formed from nitrocellulose.

Dry-cell battery. F. H. CIRVES. U. S. 1,643,486, Sept. 27. Structural features.

Dry-cell battery. W. F. HENDRY. U. S. 1,644,017, Oct. 4. Structural features.

Molding bobbins for dry-cell electric batteries. YALE ELECTRIC CORPORATION. Brit. 262,960, Dec. 30, 1925.

Storage battery. S. DALL'ANESE. Brit. 262,804, Dec. 12, 1925. Structural features.

Storage battery. W. B. STONE. Brit. 263,024, May 19, 1926. Structural features.

Storage battery. W. E. HOLLAND and W. H. GRIMDITCH. U. S. 1,644,590, Oct. 4. Batteries are formed with dry, reversible, positive and negative plates (having a substantial proportion of their active materials in the charged state), and with separators of hard rubber or other non-absorbent insulating material.

Storage-battery plate. C. H. O. LÜBECK. Swed. 62,208, Jan. 4, 1927. Structural features.

Storage-battery plate. SVENSKA ACKUMULATOR AKTIEBOLAGET JUNGNER. Swed. 62,235, Jan. 11, 1927. Structural features.

Treating lead storage battery plates. ACKUMULATOR-FABRIKSAKTIEBOLAGET TUDOR. Swed. 63,357, July 19, 1927. Air-resistant negative lead sponge plates are produced by washing out the forming electrolyte and removing the adhering water by drying in absence of oxygen. Before the washing the fully charged plates are given a slight discharge with a high current density.

Storage battery separator. P. E. NORRIS. U. S. 1,644,853, Oct. 11. Separators are formed of a fabric which may be composed of coarsely woven cotton, the strands of which are coated with rubber which partially fills the interstices of the fabric.

Protecting the lead lining in wooden tanks for electric storage batteries. ACKUMULATOR-FABRIKSAKTIEBOLAGET TUDOR. Swed. 63,309, July 12, 1927. Between the wooden tank and the lead lining there is laid in a chem. resistant and elec. insulating lining of rubber or ebonite, in order to protect the lead lining against corrosion.

Arrangement of ventilation on electric storage battery cells. SVENSKA ACKUMULATOR AKTIEBOLAGET JUNGNER. Swed. 62,981, May 17, 1927. Mech. features.

Electrolyzer electrode of the filter press type. R. PECHKRANZ. U. S. 1,643,900, Sept. 27.

Photoelectric cell. T. R. GOLDSBOROUGH. U. S. 1,645,280, Oct. 11.

Electrolytic rectifier. LERUE P. BENSING. U. S. 1,645,085, Oct. 11. A Pb anode is used with a cathode which may be formed of Mg and with an aq. fluoride electrolyte contg. at least 5% of a suitable fluoride such as KF and a smaller proportion of an alk. hydroxide or other alkali.

Material for commutator brushes of electrical apparatus. F. C. ATKINSON. U. S. 1,644,703, Oct. 11. An oxide of Cu is mixed with pitch or other suitable fusible material of organic origin, the mixt. is subjected to destructive distn., the product is cooled, powdered and mixed with a binder contg. Cu and this mixt. is molded and baked.

Electrodeposition of molybdenum. C. G. FINK and C. H. ELDRIDGE. Can. 274,429, Oct. 4, 1927. Mo is electrodeposited upon the article to be plated while serving as a cathode in an electrolyte whose Mo content is composed of an excess of H_2MoO_4 .

Electric furnace. AKT-GES. BROWN, BOVERI, ET CIE. Brit. 263,118, Dec. 15, 1925. A modification is specified of the furnace described in Brit. 261,785 (C. A. 21, 3567).

Electric resistance furnace. F. A. J. FITZGERALD. U. S. 1,643,808, Sept. 27.

Electric resistance furnace. T. A. REID. U. S. 1,645,293, Oct. 11.

Electric furnace. J. CHAPMAN. U. S. 1,645,091, Oct. 11.

Electric resistance furnace. INTERNATIONAL GENERAL ELECTRIC CO. Brit. 262,796, Dec. 9, 1925.

Electric resistance furnace for sherardizing, etc. N. E. NORTH. Brit. 262,859, Sept. 16, 1925.

Electric resistance muffle furnace. A. D. KEENE. U. S. 1,643,774, Sept. 27.

Electric resistance furnace adapted for annealing sheets of iron or steel. CHRISTIAN STEINSTRUP. U. S. 1,645,119, Oct. 11.

Electric induction furnace. J. A. SEEDE. U. S. 1,645,074, Oct. 11.

Muffle furnace (electrically heated). W. G. BRIDGE and W. A. PERVIER. U. S. 1,644,107, Oct. 4.

Electric annealing furnace. T. STASSINET. Brit. 262,800, Dec. 12, 1925. Fire-clay walls of the furnace have a thickness of 90 mm. or less and the total thickness of the fireclay and insulating walls is 150 mm. or less.

Electrode for rotary resistance furnaces. FINSPONGS METALLVERKS A.-B. Swed. 61,947, Nov. 16, 1926. In an electrode for rotary, oscillatory and rocking furnaces for the treatment of zinc powder, that part which is to produce the heat is made from coal powder high in ash; this gives it a higher elec. resistance than the other parts of the electrode, which are made from a graphite mass of higher cond.

Electrically heated hood for annealing metal sheets in packs, etc. T. F. BAILY. U. S. 1,643,600, Sept. 27.

System for ionizing gases by electric treatment. F. DESSAUER and UNIVERSITÄTS-INSTITUT FÜR PHYSIKALISCHE GRUNDLAGEN DER MEDIZIN. Brit. 262,829, Dec. 14, 1925.

Electric fuse. R. H. D. BARKLIE. U. S. 1,644,626, Oct. 4. Metal such as Au is deposited electrolytically on an electrode of Ag or other suitable sol. material so that the thickness of the metal is not substantially greater than that of com. beaten Au, the electrode material is dissolved, and the metal film is floated onto an insulating backing and the solvent is removed from the product.

Incandescent electric lamp. D. S. GUSTIN. U. S. 1,643,810, Sept. 27. An O-free, org. "getter" such as benzidine, diphenyl, crystal violet or carbazole is used with lamps of the gas filled type. Cf. C. A. 21, 1598.

Incandescent electric lamps. A. DE GRAAFF. U. S. 1,644,712, Oct. 11. An O-getter for filament lamps comprises H together with a drying agent such as P_2O_5 . The H is dild. by another gas such as A or N and constitutes 0.5-4.0% of the gaseous filling.

5—PHOTOGRAPHY

C. E. K. MEES

Photochemistry of silver iodide. LÜPPO-CRAMER. *Phot. Ind.* 25, 806-7(1927).—AgI emulsions, with grains so fine that the coated emulsion is transparent, have an increased light sensitivity when treated with free Br. With longer treatment, sensitivity decreases. A similar effect is given by treatment with Cl. A. P. H. T.

An arithmetical method of determining the exposure time in photography. B. SCHULTZE-NAUMBURG. *Z. wiss. Phot.* 24, 385-90(1927).—The time of exposure necessary is given by the proportionality factor C divided by the product of the albedo and the illumination. C depends only on the plate speed and the relative aperture of the objective. The albedo is the ratio of the reflected to the incident light. E. R. B.

Production of photographic images on cellulose acetate film. A. J. HALL AND R. A. HILL. *J. Soc. Dyers Colorists* 43, 291-2(1927).—Satisfactory images with S R A colors could not be produced on yarn but were obtained on cellulose acetate (Celastoid) film. These prints were not permanent since on exposure to light they become uniformly blue in color. A method for making the prints permanent has not yet been found. L. W. RIGGS

Mechanism of formation of the latent photographic image. F. C. TOY. *Nature* 120, 441(1927).—Recent explanations of the formation of the latent image ascribe it (1) to a complete loss of electrons and photoelec. effect, or (2) to a redistribution of electrons in the system and photo-conductivity effect. The chief obstacle to the latter is the decrease of the photo-conductivity effect found by Choblenz for wave lengths shorter than $420\text{ m}\mu$. Toy now finds that the photo-conductivity of Ag halides varies with the thickness of the halide layer and that for layers of 0.07 nm. , the photo-conductivity effect is greater at $365\text{ m}\mu$ than at $430\text{ m}\mu$. The wave-length effects in thin layers are, therefore, in accord with the known properties of the photographic emulsion. C. F. K. MEES

The laws governing the densities produced in photographic emulsions. M. C. NEUBURGER. *Phot. Kor.* 62, 175-83(1926).—A summary of published work in which the characteristic curve of a photographic emulsion is described and an explanation given for its shape in terms of relations between distribution of size and sensitivity of AgBr grains. Proof of cryst. structure of AgBr grains by Debye-Scherrer x-ray spectrograph is outlined. Reciprocity law, dependence of gamma on wave length, the formation of latent image, and characteristic curves for x-rays and α -rays are discussed. A self-registering microphotometer using thermopile and galvanometer is described. Bibliography is appended. M. W. SEYMOUR

The handling of old print-out papers. F. FORMSTECHE. *Camera (Lucerna)* 5, 180-3(1927).—Print-out papers tend to dry out with age. Papers relatively high in AgCl and low in AgNO₃ tend to become more contrasty. Other papers tend to become softer, because of conversion of AgNO₃ to Ag citrate, which is insol. Gelatin papers still give good prints if they have not yellowed unevenly. Collodion papers tend to dry out and become hard and impermeable to toning solns. This can be remedied by pre-bath in alc. Albumin papers, silvered by the user, tend to give up AgNO₃ to the paper and become impermeable. They are preserved at proper humidity by soda paper. Cf. *C. A.* 20, 3654. M. W. SEYMOUR

Ripening germs and the failure of the reciprocity law. LÜPPG-CRAMER. **Phot. Ind.* 25, 835 6(1927).—Investigations are described of the failure of the reciprocity law on several positive emulsions in different colored light. Decrease in density with decreased light intensity during exposure is called the normal effect. Increase in density under the same circumstances is called the reversed Schwarzschild effect and is regarded as an exposure anomaly. Conclusion: The failure of the reciprocity law is very complicated and to a high degree depends on the ripening condition of the Ag halide. A. P. H. TRIVELLI

Comparison of the developers, metol-hydroquinone and metoquinone. EUGÈNE MULLER. *Rev. franç. phot.* 7, 193 4; *Chem. Zentr.* 1926, II, 1230.---*Meloquinone* is an addn. compd. of hydroquinone and methyl-*p*-aminophenol sulfate. This developer was compared with a series of developers prepd. from different proportions of metol and hydroquinone. The results are compiled in tables. C. C. DAVIS

Method for the instantaneous photography of the combustion process of flashlights. H. BECK AND J. EGGERT. *Z. wiss. Phot.* 24, 367-79(1927).—An app. was constructed for following up with instantaneous photographs the combustion of flashlights. It consists of an enclosed roller (shut off from light), fed with a photographically light-sensitive material, which moves past a slit during the flash. From the record photograph there can be derived, within the exptl. limits: the intensity of the flash at any point of time, including that of the highest intensity; the entire energy of the emitted light; the total and the practical duration of the flash (total burning time = time from the first glow to the final extinction of the flash; practical burning time = duration of the practically utilizable portion of the flash). The flashlight was compared with other light sources as to its actinic value and its brightness. For 1 g. Agfa flash powder at 1 m. distance the following values were obtained: max. intensity, 1.2×10^6 Hefner c.;

entire energy, 6.9×10^4 meter candle seconds; total duration of burning, 0.183 sec.; practical burning, 0.106 sec.

E. P. WIGHTMAN

Photomicrography with low magnification of opaque objects. F. KAHLER. *Z. wiss. Phot.* **24**, 361-6(1927).—A description is given of an optical system, with which good results are obtainable.

A. P. H. TRIVELLI

Determination of iodide in mixtures of halides [in the examination of photographic paper] (BAINES) **7**.

Photographic emulsion. W. DIETERLE, O. MATTHIES and J. REITSSTOTTER. *Can.* **273**, 683, Sept. 6, 1927. Photographic Ag halide emulsions are comprised of substances which are extd. from proteins by electro dialysis.

Photographic desensitizers. I. G. FARBENIND. A.-G. *Brit.* **262**, 816, Dec. 11, 1925. *p*-Ethoxyquinaldimethyl sulfate or other alkyl sulfate of a *p*-alkyloxyquinaldine is condensed with *m*-nitrobenzaldehyde, *e. g.*, by boiling with glacial HOAc and copellidine, to form a product having a desensitizing action upon AgBr emulsions or photographic plates formed with such emulsions.

Projection-printing system for color photography. SOC. DU FILM EN COULEURS KELLER-DORIAN AND P. A. RICHARD. *Brit.* **263**, 115, Dec. 19, 1925.

Photographic copying by the reflecting method. ALFRED MILLER. *U. S.* **1,645**, 112, Oct. 11. Treatment of the sensitized colloid layer after exposure is restricted to the surface of the layer.

6—INORGANIC CHEMISTRY

A. R. MIDDLETON

Double sulfates of bismuth and alkali metals. I. Sulfates of bismuth and potassium. V. CAGLIOTI AND A. STOLFI. *Atti accad. Lincei* [6], **5**, 896-901(1927).—The system $\text{Bi}_2(\text{SO}_4)_3 \cdot \text{K}_2\text{SO}_4 \cdot \text{H}_2\text{O}$ at 25° was studied. The results, which are given in tabular and graphical form, indicate only 1 double salt, the *compd.* $\text{Bi}_2(\text{SO}_4)_3 \cdot 3\text{K}_2\text{SO}_4$, hexagonal crystals. It is stable in solns. contg. 5.32 to 12.8% of K_2SO_4 . It is also formed by adding, in the theoretical proportions, aq. K_2SO_4 to concd. aq. $\text{Bi}(\text{NO}_3)_3$ acidified with HNO_3 . The *compd.* $\text{KBi}(\text{SO}_4)_2$ described in the literature could not be found, perhaps because the conditions of the present work differed from those under which it was supposedly prepd. (cf. *Am. Chem. J.* **14**, 170(1892)). Because of hydrolysis of $\text{Bi}_2(\text{SO}_4)_3$, the method used by Zambonini and his collaborators in their numerous researches on double salts of the rare earths was not applicable, and solid $\text{Bi}_2(\text{SO}_4)_3$ in different proportions was added to satd. aq. K_2SO_4 , contg. in some cases excess K_2SO_4 .

C. C. DAVIS

Observations on soluble metatungstates. F. F. SMITH. *Chem. News* **135**, 113-5(1927); cf. *C. A.* **21**, 3171.—The literature on Pb metatungstates is contradictory and therefore confusing. Both W. Lotz and V. Forcher claimed to have prepd. the salt while Rosenheim maintained that it did not exist. S. repeated the method of F., obtained the crystals, but on attempting to dissolve them in order to purify them a white residue was formed. He then undertook to prep. the salt by dissolving 50 g. of Na metatungstate and an equiv. amt. of $\text{Pb}(\text{NO}_3)_2$ in 2.5 l. of H_2O at 80° . After repeated filtering and evapn. at 70° a crop of silky, white needles was obtained which did not prove to be the $\text{PbO} \cdot 4\text{WO}_3$, aq. desired. The insol. white powder that is obtained in the process was found to contain PbO , WO_3 and H_2O , in the same proportions as a ditungstate, and is most probably a product of hydrolysis. The Na metatungstate used was found to be impure. *Ibid* 129-31.—Ba metatungstate is prepd. by treating a hot concd. soln. of the Na salt with an equiv. amt. of BaCl_2 and a few drops of HCl, filtering, cooling and recrystg. the crop of crystals obtained. These may be reconverted into the Na salt with Na_2CO_3 . When treated with $\text{Pb}(\text{NO}_3)_2$ at 70° , the insol. white powder is formed, as before. If the filtrate from the original Pb salt is allowed to evap. at room temp., instead of heating, then in a week or two crystals of $\text{PbO} \cdot 4\text{WO}_3 \cdot 7\text{H}_2\text{O}$ sep. out. The salt may be analyzed by 1 of 3 methods: (1) by converting the Pb into sol. PbCl_2 with hot concd. HCl; (2) by dissolving in NaOH or KOH, pptg. Pb on Pt gauze electrolytically, redissolving it in warm dil. HNO_3 , igniting the $\text{Pb}(\text{NO}_3)_2$ and weighing as PbO ; pptg. the W from acid soln. with quinine, filtering the pptd. quinine tungstate, washing, igniting and weighing as WO_3 ; (3) by volatilizing the W by passing CCl_4 over the salt in a porcelain boat, weighing the Pb as PbCl_2 and igniting the W *compd.* collected, and weighing as WO_3 . $\text{Na}_2\text{O} \cdot 4\text{WO}_3 \cdot 10\text{H}_2\text{O}$ is prepd. from 5:12 Na tungstate

soln. with H_2WO_4 at 70° . NH_4 metatungstate is prepd. from 5:12 NH_4 tungstate and H_2WO_4 solns. at 70° . J. BALOZIAN

Double sulfates of the rare earth metals and the alkali metals. VIII. Double sulfates of cerium (cerous) and sodium. F. ZAMBONINI AND S. RESTAINO *Atti accad. Lincei* [6], 5, 828-32(1927); cf. C. A. 21, 711, 2855.—The system $\text{Ce}_2(\text{SO}_4)_3$ - Na_2SO_4 - H_2O at 25° was studied by the same method as before, the results of which are given in tabular and graphical form. The data indicate the existence of 2 double salts, the compd. $\text{Ce}_2(\text{SO}_4)_3 \cdot \text{Na}_2\text{SO}_4 \cdot 2\text{H}_2\text{O}$ and the compd. $4\text{Ce}_2(\text{SO}_4)_3 \cdot 5\text{Na}_2\text{SO}_4 \cdot 8\text{H}_2\text{O}$, the first of which has long been known (cf. *Ann. Pharm.* 42, 134; *J. prakt. Chem.* 80, 16(1860); *Bull. soc. chim.* 31, 533(1874)), whereas the other is new. Both are microcryst. powders. $\text{Ce}_2(\text{SO}_4)_3 \cdot \text{Na}_2\text{SO}_4 \cdot 2\text{H}_2\text{O}$ is stable in contact with solns. contg. from 0.14% Na_2SO_4 and 0.35% $\text{Ce}_2(\text{SO}_4)_3$ to approx. 7% Na_2SO_4 . $4\text{Ce}_2(\text{SO}_4)_3 \cdot 5\text{Na}_2\text{SO}_4 \cdot 8\text{H}_2\text{O}$ is stable in contact with solns. practically free of $\text{Ce}_2(\text{SO}_4)_3$, but which contain from approx. 7.5 to 15% Na_2SO_4 . The soly. data of aq. $\text{Ce}_2(\text{SO}_4)_3$ in Na_2SO_4 differ from those of Barre (C. A. 5, 435). Both compds. lose water only at high temps., and dehydration is not complete until 400° is reached. X. Sulfates of neodymium and ammonium. F. ZAMBONINI AND A. STOLFI. *Ibid* 832-7.—At 25° the system $\text{Nd}_2(\text{SO}_4)_3$ -(NH_4) $_2\text{SO}_4$ - H_2O furnished only the compd. $\text{Nd}_2(\text{SO}_4)_3 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot 8\text{H}_2\text{O}$, stable in contact with solns. contg. from 2.5% $\text{Nd}_2(\text{SO}_4)_3$ and 1% (NH_4) $_2\text{SO}_4$ to 0.58% $\text{Nd}_2(\text{SO}_4)_3$ and 44% (NH_4) $_2\text{SO}_4$. It had a d. of 2.590, from which the calcd. mol. vol. is 329.4. Complete crystallographic data of the macroscopic crystals are given. They are monoclinic and correspond perfectly to those of the La-NH_4 , Ce-NH_4 , Di-NH_4 and Nd-Tl double salts already described. C. C. DAVIS

A new group of azido mixed salts. A. C. VOURNAZOS. *Z. anorg. allgem. Chem.* 164, 263-73(1927).—V. prepd. the compd. $\text{Na}_3[\text{AsBr}_3(\text{N}_3)_3]$ from NaN_3 and AsBr_3 in CH_3OH soln. It crystd. in white needles and gave no reaction with a CH_3OH soln. of AgNO_3 . He obtained mixed zinc halogen azides of the type $[\text{ZnNi}_2\text{N}_3\text{N}:\text{N}]\text{M}$. In this prepn. the Zn halides and NaN_3 were very thoroughly dried and the reaction was brought about in dry acetone soln. except in the case of the chlorides, fluorides and cyanides. With the latter CH_3OH was used as the reaction medium. The Zn halides and monobasic org. Zn salts gave the same coordinate mixed type of compd. The members of this group are white or colorless cryst. substances, sol. in CH_3OH , $(\text{CH}_3)_2\text{CO}$, and C_6H_6 , and insol. in ether. They are crystd. out by means of the latter. They give a deep red coloration with FeCl_3 (1:100) and a dark brown with the same concn. of CuSO_4 . Pb and Ag compds. of the type $\text{AgI} \cdot [\text{ZnI}_2 \cdot \text{NaN}_3]_2$ and $\text{PbI}_2 \cdot [\text{ZnI}_2 \cdot \text{NaN}_3]_4$ were prepd. The cyanide was assigned the formula $[\text{Zn}(\text{CN})_2(\text{N}_3)_3]\text{Na}_4$. C. E. P. JEFFREYS

Preparation and properties of aluminum perchlorate with fifteen molecules of water of crystallization. D. DOBROSERDOV AND A. PSHENICHNI. *Ukrainskii Khem. Zhurnal* 2, 109-18; *Chem. Zentr.* 1926, II, 2404.—Freshly pptd. $\text{Al}(\text{OH})_3$ is dissolved in const.-boiling $\text{HClO}_4 \cdot 2\text{H}_2\text{O}$ on the water bath. On cooling, crystals of $\text{Al}(\text{ClO}_4)_3 \cdot 15\text{H}_2\text{O}$ sep., which are stable at room temp., but which lose $3\text{H}_2\text{O}$ in the desiccator and lose $9\text{H}_2\text{O}$ at 100° . The satd. aq. soln. at 18.5° contains 6.86% $\text{Al}(\text{ClO}_4)_3 \cdot 15\text{H}_2\text{O}$, that at 90° contains 42.3%. From the mother liquor of $\text{Al}(\text{ClO}_4)_3 \cdot 15\text{H}_2\text{O}$ and from the soln. prepd. by dissolving $\text{Al}(\text{OH})_3$ in $\text{HClO}_4 \cdot 2\text{H}_2\text{O}$ at room temp., small needles were obtained, the compn. of which corresponded approx. to the formula: $\text{Al}(\text{ClO}_4)_3 \cdot 15\text{H}_2\text{O} + 23.66 [\text{HClO}_4 \cdot 1.98\text{H}_2\text{O}]$. The analyses of the salts were carried out by the new method of D. (cf. C. A. 21, 2447). C. C. DAVIS

Preparation of aluminum perchlorate with nine and with six molecules of water of crystallization, and a study of the former with respect to its solubility, dehydration and behavior when heated. D. DOBROSERDOV AND VL. ERDMANN. *Ukrainskii Khem. Zhurnal* 2, 119-35; *Chem. Zentr.* 1926, II, 2404; cf. preceding abstr.—The hydrate $\text{HClO}_4 \cdot 2\text{H}_2\text{O}$ dissolves on the water bath about $\frac{1}{3}$ mol. of $\text{Al}(\text{OH})_3$, giving a colloidal soln. which on cooling solidifies to a gel. If 1 more mol. of $\text{HClO}_4 \cdot 2\text{H}_2\text{O}$ is added to the soln. and the latter is evapd., long 6-sided prisms of the compn. $\text{Al}(\text{ClO}_4)_3 \cdot 9\text{H}_2\text{O}$ are deposited. These deliquesce in the air, the resulting soln. having the approx. compn. $\text{Al}(\text{ClO}_4)_3 \cdot 15\text{H}_2\text{O}$. Over H_2SO_4 or P_2O_5 it loses $3\text{H}_2\text{O}$, and at 100° it fuses without loss of water. When heated in a Pt crucible the salt is converted to Al_2O_3 , obviously not through the intermediate stage of AlCl_3 , because there is no loss of Al. The existence of enneahydrate and of hexahydrate agrees with the theory of Flawitzkis, according to which the hydrates of halogen salt derivs. are hydrated acids. According to this the enneahydrate is a salt of the ortho-form of perchloric acid $\text{Cl}(\text{OH})_7$, because $(\text{HClO}_4)_3 \cdot 9\text{H}_2\text{O}$ is equiv. to $3\text{Cl}(\text{OH})_7$. The hexahydrate is similarly a deriv. of the "first anhydride of the ortho-form," $\text{OCl}(\text{OH})_6$. At 0° , 100 g. of water

dissolves 463 g. of $(\text{HClO}_4)_3 \cdot 9\text{H}_2\text{O}$, at 14.3° , 564 g. and at 91.5° , 3065 g. The method of Willard (*C. A.* 7, 311) for the prepn. of HClO_4 from NH_4ClO_4 , HNO_3 , and HCl can also be used for the prepn. of N_2O . C. C. DAVIS

The salts of iron and boron. N. S. KURNAKOV AND F. A. KOTOMIN-BUDARIN. *Ann. inst. anal. phys. chem.* 3, 488-9 (1926).—When 1-1.5 mol. $\text{FeC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ and 1 mol. B_2O_3 are heated to 1000° in an Fe crucible, $(\text{FeO})_2\text{B}_2\text{O}_3$ is obtained. $(\text{FeO})_2\text{B}_2\text{O}_3$ results with 2.5 mols. of the oxalate, and $\text{Fe}_3\text{B}_2\text{O}_7$ appears at 1400° with 3 mols. Below 700° $(\text{FeO})_2\text{B}_2\text{O}_3$ and $\text{FeO}(\text{B}_2\text{O}_3)_2$ are produced as sep. phases. BASIL C. SOYENKOFF

Organic compounds of quinquivalent bismuth. G. CHARRIER. *Atti accad. Lincei* [6], 5, 889-92 (1927).—In a similar way to their reactions with SbCl_3 (cf. May, *C. A.* 7, 70), aryldiazonium chlorides react with BiCl_3 , forming aryldiazonium chlorobismuthates, thus: $\text{ArN} \cdot \text{NCl} + \text{BiCl}_3 \rightarrow \text{ArN} \cdot \text{NBiCl}_4$. These new compds. also have their analogs in compds. such as $\text{ArN}_2 \cdot \text{AuCl}_4$, $(\text{ArN}_2)_2\text{HgCl}_4$, $(\text{ArN}_2)_2\text{SnCl}_4$ and $\text{ArN}_2 \cdot \text{BF}_4$, all of which have been described. They were prepd. by adding BiCl_3 in aq. HCl to the aryldiazonium chloride soln. There were prepd. in this way the following diazonium chlorobismuthates: phenyl, lustrous, m. $85-7^\circ$ (decompn.); o-tolyl, lustrous, m. $115-20^\circ$ (decompn.); m-tolyl, lustrous, slightly yellow, m. around 120° (decompn.); p-tolyl, lustrous, m. around 120° (decompn.); p-anisyl, lustrous straw color, m. around $145-7^\circ$ (decompn.); p-chlorophenyl, brilliant, silky, m. $105-7^\circ$ (decompn.); p-bromophenyl, lustrous, m. $135-40^\circ$ (decompn.). All these compds. are very stable in air and decomp. only very slowly. With dil. caustic alkalies they evolve N and form basic Bi salts, and with hot dil. acids they evolve N, forming the Bi salt and the phenol. With 1:1 HCl and Cu powder they give the Sandmeyer reaction. With concd. H_2SO_4 they evolve HCl and probably form the corresponding sulfates $\text{ArN} \cdot \text{NBi}(\text{SO}_4)_2$, which are very stable and can be heated in concd. H_2SO_4 at 100° for some time without much decompn., though ultimately decompn. ensues, with formation of N, $\text{Bi}_2(\text{SO}_4)_3$ and the phenolsulfonic acids. The compds. $(\text{ArN} \cdot \text{N})_2\text{BiCl}_6$ and $(\text{ArN} \cdot \text{N})_2\text{BiCl}_6$ could not be prepd. C. C. DAVIS

The reduction of alumina and other oxides by tungsten at high temperatures. H. v. WARTENBERG AND H. MOEHL. *Z. physik. Chem.* 128, 439-44 (1927).—A small rod of Al_2O_3 heated in a W-wire furnace failed to melt at 2100° (m. p. 2050°) but reacted to form a crust of fine black crystals on the rod, the heating filament decreasing in diam. and WO_2 depositing on the sides of the furnace. It was shown that this reaction could not be explained by the presence of O_2 in the N_2 atm. The phenomenon is explained by the vaporization of Al_2O_3 , a reaction between the gaseous Al_2O_3 and the W-filament to form Al and WO_2 and the migration of the WO_2 and the gaseous Al to the Al_2O_3 rod, where on account of a lower temp. the reaction at the filament reversed and W and Al_2O_3 formed. Similar results were obtained with MgO , ZrO_2 and ThO_2 , at somewhat different temps. These reactions are correlated with the Nernst approximation formula and found to be in agreement. The results are interpreted to be in confirmation of the former conclusion (*C. A.* 17, 2835) that ThO_2 in W lamps must be effective as Th, though within the W filaments ThO_2 can be found because of the retention of the WO_2 vapor. ROBERT F. MEHL

Notes on the composition and behavior of precipitated copper and iron sulfides. F. FEIGL. *Z. anal. Chem.* 72, 32-43 (1927).—A careful study of Cu sulfide ppts. formed in acid solns. shows that it is not yet positively known whether the ppt. is CuS or Cu_2S and S. When formed from alk. solns. the ppt. appears to be a mixt. of Cu_2S and CuS . In the case of the Fe salts it is fairly certain that $(\text{NH}_4)_2\text{S}$ ppts. Fe_2S_3 from ferric solns. but it is not so generally known that Fe_2S_3 is also formed when yellow $(\text{NH}_4)_2\text{S}_2$ is added to a ferrous soln. It is a curious fact that the ppt. now recognized as Fe_2S_3 behaves toward Zn soln. as if it were of this compn. but toward HgCl_2 it reacts as if it were FeS . Apparently the Fe_2S_3 can exist as $\text{FeS} \cdot \text{FeS}_2$ and this may be called, not tautomerism, but valence isomerism. W. T. H.

Germanium. XXII. The dihalides of germanium. F. M. BREWER AND L. M. DENNIS. *J. Phys. Chem.* 31, 1526-38 (1927).—An attempt to prepare GeCl_2 failed. GeBr_2 and GeI_2 as well as the bromoform were made as proven by analysis. Some properties of these compds. were detd. The dihalides possess strong reducing powers similar to those of tin. R. H. LAMBERT

Hydrates of aluminum nitrate. G. MALQUORI. *Atti accad. Lincei* [6], 5, 892-6 (1927).—The system $\text{Al}(\text{NO}_3)_3 \cdot \text{H}_2\text{O}$ was investigated between -27° (the cryohydric point) and the temp. at which $\text{Al}(\text{NO}_3)_3$ decompn. with liberation of HNO_3 . From -27° to 73.5° , the m. p. of $\text{Al}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$ is in equil. with satd. solns. Above 73.5° , the soly. curve exhibits a sharp discontinuity, corresponding to the existence of 2 hydrates with less H_2O of crystn., viz., $\text{Al}(\text{NO}_3)_3 \cdot 8\text{H}_2\text{O}$ and $\text{Al}(\text{NO}_3)_3 \cdot 6\text{H}_2\text{O}$. The point

where the 2 curves meet has an abscissa corresponding to a ratio $\text{Al}(\text{NO}_3)_3/\text{H}_2\text{O}$ which is lower than that conforming to $\text{Al}(\text{NO}_3)_3 \cdot 8\text{H}_2\text{O}$. This indicates that $\text{Al}(\text{NO}_3)_3 \cdot 8\text{H}_2\text{O}$ undergoes partial fusion, decomp. into $\text{Al}(\text{NO}_3)_3 \cdot 6\text{H}_2\text{O}$ and its soln. All 3 hydrates have already been prepd. in other ways (cf. Seligman and Williams, *C. A.* 10, 2672; Inamura, *Mem. Coll. Sci. Kyoto* 4, 105(1919); cf. *C. A.* 14, 2451). C. C. DAVIS

The application to iron and neodymium oxides of a general method for the synthesis of silicates. A. DUBOIN. *Compt. rend.* 185, 116 7(1927).— SiO_2 and Nd_2O_3 are added to KF or KHF_2 , previously melted in a Pt crucible. After cooling the mass is fused with KCl and then extd. with H_2O . By fractional crystn. a fine, cryst. product is obtained corresponding to the formula: $\text{Nd}_2\text{O}_3 \cdot 3\text{K} \cdot 0.9\text{SiO}_2$. The method is applicable to Fe but it is more difficult to fractionate the product. E. G. V. B.

The *cis-trans* isomerism of metallic salts of the type $\text{R} \cdot \text{M}^n\text{X}_2$. F. KRAUSS AND F. BRODKORB. *Z. anorg. allgem. Chem.* 165, 73-8(1927).—Compds. of Pd of the type Py_2PdCl_2 and $(\text{C}_2\text{H}_5\text{NH}_2)_2\text{PdCl}_2$, where Py represents the pyridine mol., are produced in the two isomeric forms. They are mono-molecularly sol. in phenol. The yellow *trans*-diammine-dichloropalladium compd., $(\text{NH}_3)_2\text{PdCl}_2$, is similarly sol. in water. E. O. ELLINGSON

The nature of the luteo cobalt complex. WILHELM BILTZ. *Z. anorg. allgem. Chem.* 164, 245-55(1927).—A summary of the properties of the $\text{Co}(\text{NH}_3)_6^{3+}$ ion based on the x-ray spectroscopic (Meisel and Tiedge, *C. A.* 21, 3500), mol. vol. (Biltz and Birk, *C. A.* 17, 2683; 18, 1930; 20, 2924; Birk, *C. A.* 21, 677) and magneto-chemical (Rosenblum, *C. A.* 14, 1922) measurements. DAVID DAVIDSON

Ruthenium. X. The "isomeric" chlorides. J. I. HOWE. *J. Am. Chem. Soc.* 49, 2381-93(1927); cf. *C. A.* 20, 560.—There is no isomerism among the known complex chlorides of Ru. Salts of the series which has been considered to be $\text{M}_2\text{Ru}^{\text{III}}\text{Cl}_6$, contg. tervalent Ru, really contain quadrivalent Ru and have the formula $\text{M}_2\text{Ru}^{\text{IV}}\text{Cl}_6\text{OH}$. The so-called "aquo" series is actually the ordinary series of tervalent Ru; the salts of this series crystallize as monohydrates of the formula $\text{M} \cdot \text{Ru}^{\text{III}}\text{Cl}_5 \cdot \text{H}_2\text{O}$. In all of these salts the coordination no. of Ru is six. Claus' view that the blue soln. of reduced Ru contains Ru in bivalent form is again confirmed. LOUISE KELLEY

A separation of hafnium and zirconium by precipitation of the phosphates from sulfuric acid solution. J. H. DE BOER. *Z. anorg. allgem. Chem.* 165, 16-20(1927); cf. *C. A.* 20, 1153.—This method depends on the facts that Hf complexes are more easily decomposed than the corresponding ones of Zr and that $\text{Hf}_2(\text{PO}_4)_4$ is less sol. than $\text{Zr}_2(\text{PO}_4)_4$. The pptd. phosphates are divided into 2 equal parts. The first is dissolved in HF, repptd. as the hydroxides with either KOH or NaOH, filtered and washed free from F and phosphates and redissolved in concd. H_2SO_4 . The remainder of the ppt. is dissolved, directly, in concd. H_2SO_4 . The 2 solns., thus obtained, are united. Dilg. with H_2O ppts. the phosphates, the ppt. being richer in Hf than Zr. The process is repeated with the first fractions until pure Hf is obtained, while the metals in the mother liquors are pptd. with H_3PO_4 and may be used for a new fractionation. Pb-lined dishes were first used for the concd. H_2SO_4 solns. and as the quantities grew less, porcelain ones. In an actual expt. 860 g. of ignited phosphate, contg. 20% Hf, required 3 l. of concd. H_2SO_4 to dissolve the pptd. hydroxides and 9 l. for the remaining phosphates. Pure Hf can be obtained by 12-15 fractionations, while 26 are required to obtain pure Hf from a $\text{Zr}_2(\text{PO}_4)_4$ soln. contg. 2% Hf, by the pptn. of the phosphates from an oxalic acid soln. A fractionation essentially similar to this, described by Bardet and Toussaint (*C. A.* 19, 2779), is difficult because of the necessity for using large quantities of concd. H_2SO_4 . J. BALOZIAN

The separation of hafnium and zirconium by fractional decomposition of the complex phosphato fluorohafnates and zirconate. J. H. DE BOER AND P. KOETS. *Z. anorg. allgem. Chem.* 165, 21-30(1927); cf. *C. A.* 20, 1153.—Hf and Zr complexes of F and H_2PO_4 are fractionally decomposed with borax, F combining with B and the 2 phosphates being pptd. The phosphates were extd. from the mineral malacon by treating with concd. H_2SO_4 , H_2O , H_3PO_4 and HCl in a cast-Fe vessel. In an actual fractionation, carried on in wooden app., 4.5 kg. of phosphates, from other sec. fractions and contg. 20% Hf, is dissolved in 10 l. concd. HCl, 3.5 kg. moist NH_4HF_2 (2 kg. dry) and 30 l. H_2O . After adding 1.5 l. H_3PO_4 (1:4), the temp. is lowered to 30° and the first fraction of phosphate (3.3 kg. pyrophosphates, contg. 25% Hf) is pptd. with 1.75 kg. borax and filtered. The second (1 kg., contg. 7% Hf) is pptd. with 0.75 kg. more borax, Hf and Zr being exhausted in the mother-liquor. These combined with others, totaling 7 kg., were dissolved and repptd., the first fraction giving 5 kg., contg. 30% Hf. This repeated 7 times with first fractions, gives 85% Hf (apparent) and 60% Hf (actual). Further purification is impossible, as small glass app. cannot be used. The Hf content

of samples is detd. with a vacuum Röntgen spectrograph. The influence of the hydrolysis of the complex, resulting in the removal of H_3PO_4 , the formation, in part, of the double fluorides of Hf and Zr, and the hydrolysis of the pptd. phosphates are discussed. The presence of Ta influences the $L_{\alpha 1}$ -lines of Hf so that the results seem lower than they actually are.

J. BALOZIAN

The different stabilities of similarly formed complexes of hafnium and zirconium. J. H. DE BOER. *Z. anorg. allgem. Chem.* 165, 1-15 (1927); cf. *C. A.* 20, 1153.—Although the ability of Zr and Hf to form complexes of the same type is about the same, the slight difference in their ionic vol. indicates that the stabilities of these, when similarly formed, are different. Zr combines somewhat more easily with other ions than does Hf, while complexes of Hf are somewhat more readily decomposed than those of Zr. In acid solns. this is found to be true with oxalic, concd. H_2SO_4 , concd. H_3PO_4 (the phosphates being pptd. on dilg. with H_2O), phosphofluorozirconic (hafnic) acid, concd. HNO_3 , concd. HCl, the complex fluorides (e. g., $(\text{NH}_4)_2\text{HfF}_6$) and lakes. $\text{Hf}_2(\text{PO}_4)_4$ and $\text{Zr}_2(\text{PO}_4)_4$ ppt. on adding H_2O , but are redissolved by HF. Complexes formed in concd. HNO_3 are less stable than those in concd. H_2SO_4 ; their phosphates are no longer sol. in it, but the arsenates are sol. Complex formation in concd. HCl is even less than in concd. HNO_3 , but in very concd. HCl compds. of the type $\text{H}_2(\text{HfOCl}_4)$ are formed. Alkali carbonates ppt. from Hf and Zr oxychloride solns. a complex which is sol. in excess carbonate. Here again, the Zr complex is more easily formed and the Hf more easily decompd. This is also found to be true of many org. hydroxyl compds. (the poly alcs. and hydroxy acids). Perzirconate and perhafnate solns. (from the metal, H_2O_2 and NaOH) are gradually decompd. on heating, $\text{Hf}(\text{OH})_4$ and $\text{Zr}(\text{OH})_4$ being pptd. The soln. is richer in Zr, the ppt. in Hf and the Zr compd. is more stable than the Hf. Alc. partially crystallizes these salts, also richer in Hf. Hf compds. are more easily decompd. by heat than the Zr. The ionic vol. of Hf is greater, while the at. vol. of Zr is greater. Arsenates are more sol. than phosphates, but other chem. properties of both are similar, the soly. of the Hf salts being less than that of the Zr salts.

J. BALOZIAN

Tin salts of organic acids. E. ELÖD AND F. KOLBACH. *Z. anorg. allgem. Chem.* 164, 297-312 (1927).—Alkali stannous and stannic salts of formic acid were obtained by reaction of the alkali salts of the acid with Sn halides in 25% formic acid soln. They were sepd. by means of fractional crystn. and with a polarization microscope. The substances are strongly birefringent, six-sided crystals. They have a noticeable formic acid tension at room temp. The formula assigned was of the type $\text{Na}_2[\text{Sn}(\text{HCO}_2)_4] \cdot 5\text{H}_2\text{O}$. The Sn acetate salts were prepd. in AcOH soln.: $\text{Sn}_2\text{O}(\text{CH}_3\text{CO}_2)_2$ and $\text{Na}_2/\text{Sn}(\text{CH}_3\text{CO}_2)_6$. The reaction of 1 mol. SnCl_4 with 2 mols. $(\text{NH}_4)_2\text{C}_2\text{O}_4$ in CH_3OH or glacial AcOH yielded $[(\text{NH}_4)_2\text{C}_2\text{O}_4]_2\text{SnCl}_2 \cdot \text{H}_2\text{O}$. The Na, K and NH_4 formates, acetates and oxalates were obtained without difficulty, but the K salt analogous to Na dichlorostannoöxalate was not obtained. Instead, $(\text{KO}_2\text{C}\cdot\text{CO}_2)_2\text{SnO}_2\text{C}\cdot\text{CO}_2\text{Sn}(\text{O}_2\text{C}\cdot\text{CO}_2\text{K})_2$ was found. A possible structure assigned to the stanñoöxalate is $\text{Na}_2\text{—}\left[\text{Sn}\cdot\left(\text{O}_2\text{C}\cdot\text{CO}_2\text{N}\right)_2\right]_2$, giving to tin the coördination number 6. C. E. P. JEFFREYS

The inter-relationships of the sulfur acids. HENRY BASSETT AND R. G. DURRANT. *J. Chem. Soc.* 1927, 1401-68.—A study of the behavior of many of the S acids and an attempt to explain the genesis of polythionates in the Wackenroder reaction and in the decompn. of thiosulfates by acid. The first products of the hydrolysis of S are probably equiv. quantities of H_2S and the very unstable sulfoxylic acid, $(\text{HO})_2\text{S}$, which is immediately transformed into H_2S and H_2SO_3 . The reaction probably takes place between $(\text{HO})_2\text{S}$ acting as an oxidizing agent and its anhydroacid, $\text{HO}\cdot\text{S}\cdot\text{O}\cdot\text{H}$, as a reducing agent to form H_2S and pyrosulfurous acid, $\text{H}_2\text{S}_2\text{O}_5$. The reversal of this reaction would be the first step in the Wackenroder reaction. Evidence for the above conclusions is based on the behavior of Na formaldehydesulfoxylate, a deriv. of $(\text{HO})_2\text{S}$. The term "hydrosulfite" to designate the salt $\text{Na}_2\text{S}_2\text{O}_4$ is suggested as preferable to "hyposulfite." The factors which det. color in simple S compds. are considered. The yellow color of certain simple S compds. is ascribed to the presence of a S atom with a 10-electron sheath. The decompn. of $\text{H}_2\text{S}_2\text{O}_4$ is discussed and representative equations are suggested. The autooxidation of H_2SO_3 is considered. The equation $\text{H}_2\text{SO}_3 + \text{H}_2\text{S}_2\text{O}_5 \rightleftharpoons \text{H}_2\text{SO}_4 + \text{H}_2\text{S}_2\text{O}_4$ is recommended as probably most expressive of the reaction. The decompn. of thiosulfuric acid is discussed at great length. In all probability the reaction $\text{H}_2\text{S}_2\text{O}_3 + \text{H}_2\text{O} \rightleftharpoons \text{H}_2\text{SO}_4 + \text{H}_2\text{S}$ does not proceed in either direction, although the sulfate may result from the trithionate formed. $\text{H}_2\text{S}_2\text{O}_3$ decomps. according to the 3 following reactions: (a) $\text{H}_2\text{S}_2\text{O}_3 \rightleftharpoons \text{H}_2\text{SO}_4 + \text{S}$; (b) $\text{H}_2\text{S}_2\text{O}_3 \rightleftharpoons \text{H}_2\text{S} + \text{H}_2\text{S}_4\text{O}_6$; (c) $2 \text{H}_2\text{S}_2\text{O}_3 \rightleftharpoons \text{H}_2\text{O} + \text{H}_2\text{S}_4\text{O}_6$. Reaction (a) takes place to the

greatest extent when acids act on thiosulfates. It is probably a bimol. reaction involving a sulfur unit S_2 . Reaction (b) is considered an essential step in the Wackenroder reaction. Contrary to the usual view in favor of $H_2S_6O_6$, $H_2S_3O_6$ is considered the primary thionic acid both in the Wackenroder reaction and in the thiosulfate decompn. The hydrolysis of $H_2S_3O_6$ is discussed. Reaction (c) takes place in very acid solns. The anhydro-acid thus formed bleaches methylene blue, by which it is converted into tetrathionic acid. Evidence of the actual existence of this acid, which might be called dithiopyrosulfuric acid, is presented. The structural formulas of the polythionates and their behavior on hydrolysis in acid and in alk. soln. are considered. A comprehensive summary is impossible in a short space. The literature is referred to and discussed throughout the article, and expts. are described to support the views of the authors.

RUBY K. WORNER

The reaction between manganese salts and sodium hypochlorite in the presence of certain other salts. B. E. DIXON AND J. L. WHITE. *J. Chem. Soc.* 1927, 1469-76.—A study of the effect of variations in the conditions of the expt. on the conversion of Mn salt into permanganate. In the presence of Cu salt, the max. amt. of $KMnO_4$ was formed at the end of 3 min. boiling and when $1/3$ of the total O_2 had evolved. The blue-violet color described by Heslinga (cf. *C. A.* 16, 2817) and attributed to the presence of Fe is due to the action of alkali on permanganates to form manganates. Cu and Co salts have very different effects: the alk. concn. is relatively unimportant with Co, although large concns. hinder permanganate formation; with Cu, it is a critical factor. With Co, the proportion of Mn salt converted decreases regularly with increase of amt. of Mn salt used; with Cu, the results are erratic, but under favorable conditions, the conversion can be quant. irrespective of the amt. of Mn salts present. In the presence of Co, the reaction is appreciably reversible, whereas with Cu it is negligibly so. The Cu ppt. soon forms an easily sepd. dense black residue which has little effect on $NaOCl$ decompn. after the permanganate has formed; the ppt. of Co is flocculent, finely divided, and difficult to filter, and throughout the reaction promotes the evolution of O_2 from $NaOCl$. Increase in the ratio of Co to Mn causes a decrease in the amt. of permanganate formed; for moderate amts. of Mn, an equiv. amt. of Cu gives the best results, although the most effective ratio is not well defined. The limit of delicacy for detection of Mn depends apparently on the amt. of permanganate capable of producing a visible tint. A large quantity of $NaOCl$ masks the color. Mn equiv. to 0.002 mg. MnO was detected. The probable mechanism of the reaction is outlined.

RUBY K. WORNER

The action of hydrogen on tin salts at high temperatures and pressures. V. IPAT'EV AND V. NIKOLAI'EV. *Compt. rend.* 185, 462-3(1927); cf. *C. A.* 20, 1572.—Compds. of tin are reduced to a variety of products in the presence of H at high temps. and pressures varying from 270° to 380° and 38 to 260 atm., resp. $Sn(OH)_4$ is reduced to metallic tin; $Sn(SO_4)_2$ to $SnSO_4$ or SnS_2 and SnS ; $SnCl_4$ to $SnCl_2$ and SnO . When a mixt. of $SnCl_4$ and $AgCl$ is heated (380° , 260 atm. 4 hrs.) small amts. of Sn and Ag are obtained, but most of the tin is eliminated in the form of $Sn(OH)Cl$. E. O. E.

The reduction of arsenic compounds in acid and in alkaline solution by sodium hyposulfite. Production of sodium arseno-hyposulfite. WALTER FARMER AND J. B. FIRTH. *J. Chem. Soc.* 1927, 2019-21; cf. *C. A.* 20, 1186.— As_2S_3 is prepd. by the reduction of certain As compds. by Na hyposulfite, 2 intermediate complex compds. are apparently formed, one of which is a decompn. product of the other. The primary intermediate complex, Na arseno-hyposulfite, $Na_3As(S_2O_4)_3$, is obtained by the action of $Na_2S_2O_4$ on Na_3AsO_3 or on Na_3AsO_4 under proper conditions. Decompn. of $Na_3As(S_2O_4)_3$ in alk. soln. in the presence of Na_2SO_3 by neutralizing the alkali is thought to lead to the formation of a secondary intermediate complex, Na arseno-thiosulfate, $Na_3As(S_2O_3)_3$, which rapidly decompn. into As_2S_3 .

RUBY K. WORNER

Contribution to the knowledge of Nessler's reagent. S. M. NAUDE. *Z. physik. Chem.* 125, 98-110(1927).—The ternary system $KI-HgI_2-H_2O$ was investigated. In order to analyze the solid phase Hg was pptd. electrolytically on a Pt dish, the complex salts were decomposed by boiling with a strongly alk. alc., the I was pptd. with 0.1 N $AgNO_3$ and the excess was back-titrated. The pptd. solid phase consists of $KHgI_3 \cdot 1/2 H_2O$.

J. A. SZILARD

Titanium sesquioxide. GULBRAND LUNDE. *Z. anorg. allgem. Chem.* 164, 341-4 (1927).— TiO_2 heated in a stream of H_2 for 20 min. at 1000° lost 4.64% in wt., whereas the transition $TiO_2 \rightarrow Ti_2O_3$ requires 10%. According to the method of Friedel and Guerin, a mixt. of H_2 and $TiCl_4$ is passed over TiO_2 at about 650° . An amorphous blue-black product and, in very small quantities, a red-violet sublimate were obtained. The temp. was then raised to 1000° and the product heated in the $TiCl_4$ stream for 30

min. X-ray investigation indicates that the product obtained is identical with that of Friedel and Guerin. Axial ratio = 1.320. $d = 4.605$ (Friedel and Guerin: $c/a = 1.316$; $d = 4.601$). RUBY K. WORNER

Besson's supposed phosphorus suboxide, P_2O . I. J. CHALK AND J. R. PARTINGTON. *J. Chem. Soc.* 1927, 1930 6.—Attempts to prep. the supposed suboxide by the action of PCl_3 on H_3PO_3 according to Besson's directions yielded apparent mixts. of variable compn. and with properties different from those ascribed to the supposed P_2O . They appear to consist of finely divided amorphous P and adsorbed H_3PO_3 . If prepd. at moderately low temps., solid H phosphides may also be present. The amt. of O_2 is insufficient to account for the formula P_2O and H_2 is always present. The mechanism of the reaction is probably a decompn. of H_3PO_3 to form phosphine which then reacts with PCl_3 to form P and, if the temp. is low, solid II phosphide. RUBY K. WORNER

An investigation of the complex chemical behavior of beryllium salts. V. R. FRICKE AND O. RODE. *Z. anorg. allgem. Chem.* 163, 31-9 (1927); cf. *C. A.* 21, 1601.—The complex chem. behavior of Be salts has been studied by a thermal analysis. The app. used is described. Cooling curves detd. the m. p. of mixts. $BeCl_2$ was studied with various nitriles such as isocaprotrile, propionitrile and toluonitrile. Naphtho- and acetonitriles could not be used because of their ease of charring. Aniline and nitrobenzene also carbonize readily. R. H. LAMBERT

The law of the non-polar atom linking and the coordination compounds of the platinum metals. H. REMY. *J. prakt. Chem.* 114, 337-47 (1926).—The law of the non-polar atom linking, which was shown previously (cf. *C. A.* 15, 300) to be valid for O acids, is extended for the coordination compds. of the Pt metals. The existence of the recently discovered chloroferrates with coordination nos. of 5 and 7 was anticipated by the law of the non-polar atom linking. J. A. SZILARR

A study of the cyanides of the platinum metals. The cyanides of ruthenium. F. KRAUSS AND G. SCHRADER. *Z. anorg. allgem. Chem.* 165, 59-72 (1927).—The salts $K_2Ru(CN)_6$ and $K_4Ru(CN)_6 \cdot 3H_2O$ were examd. and the following compds. prepd. and described: $Cu_2Ru(CN)_6 \cdot xH_2O$, $Cu_2Ru(CN)_6 \cdot 4NH_3$, $Ag_3Ru(CN)_6 \cdot xH_2O$, $Ag_4Ru(CN)_6 \cdot 3NH_3$. The brucine and strychnine salts formed by the action of these alkaloids on the acid $H_4Ru(CN)_6$ are discussed. It is concluded that the earlier assumption of the bivalence of Ru in the double cyanides is corroborated. R. O. ELLINGSON

Platinum compounds of hydrazine and isonitriles. I. A. CHUGAEV, M. S. SKANAVI-GRIGORÉVA AND A. POSNYAK. *Ann. inst. platine* 1926, No. 4, 299-305.—The authors

describe compds. of the type

$$\begin{array}{c} \text{CH}_3\text{NC} \qquad \qquad \text{CH}_3\text{NC} \\ \diagdown \qquad \diagup \qquad \diagdown \qquad \diagup \\ \text{CH}_3\text{NC} \cdots \text{Pt} \cdots \text{NH} \cdot \text{NH}_2 \cdots \text{Pt} \cdots \text{CNCH}_3 \\ \diagup \qquad \diagdown \qquad \diagup \qquad \diagdown \\ \text{CH}_3\text{NC} \qquad \qquad \text{CH}_3\text{NC} \end{array} \quad \text{X}_2 \cdot n\text{H}_2\text{O}.$$

K_2PtCl_6 with CH_3NC and $N_2H_4 \cdot H_2O$ gives $8CNCH_3 \cdot Pt_2 \cdot 2N_2H_3 \cdot Cl_2 \cdot 8H_2O$, red prisms, very sol. in H_2O , less sol. in alc., emerald-green when heated. The Cl is ionic. The iodide $[4CH_3NC \cdot Pt_2 \cdot 2N_2H_3]I_2 \cdot 4H_2O$ is a cryst., emerald-green compd., very sol. in H_2O . The perchlorate forms strawberry-red needles with 2 mols. of water of crystn. The azide forms dark blue needles. With concd. HCl the chloride forms $4CH_3CN \cdot Pt_2 \cdot 2N_2H_3 \cdot 2HCl \cdot Cl_2$, almost colorless needles, little sol. in H_2O , sol. in alkalis. Red compds. are formed with isonitriles and caustic. K_2PtCl_6 treated with C_2H_5NC , $N_2H_4 \cdot H_2O$ and $NaNO_3$ forms $[8C_2H_5NC \cdot Pt_2 \cdot 2N_2H_3](NO_3)_2 \cdot 2H_2O$, red prisms, sol. in H_2O ; perchlorate, red needles little sol. in H_2O ; iodide, yellow needles, chloroplatinate, red crystals; chloride, orange-yellow needles. With concd. HCl is formed $4C_2H_5NC \cdot Pt_2 \cdot 2N_2H_3 \cdot Cl_2 \cdot 2HCl$, a white ppt. WILLIAM M. MALISOFF

A new series of acido-amido-tetrammine derivatives of quadrivalent platinum. I. A. CHUGAEV. *Ann. inst. platine* 1926, No. 4, 37-43.—C. preps. $[Pt_4(NH_3)(NH_2) \cdot Cl]Cl_2$ by the action of alkali on $[Pt_5(NH_3)Cl]Cl_4$. This compd. requires 1 g. equiv. of acid for neutralization and turns phenolphthalein red. Similar characteristics are shown by $[Pt_4(NH_3)(NH_2) \cdot Cl]Br_2$ and $[Pt_4(NH_3)(NH_2) \cdot Cl](NO_3)_2$. Analogously another series $[Pt_4(NH_3) \cdot NH_2 \cdot Br]Br_2$ is prepd. by the action of NH_4OH on the pentammine bromide. Analyses substantiate the above formulas. W. M. M.

The chemistry of solid substances. Polymorphic transitions in HgI_2 and S (KOHLSCHÜTTER) 2. Valence and addition compounds (PERRIN) 2. Ternary systems: $Na_2CO_3-NaHCO_3-H_2O$ (HILL, BACON) 2.

7—ANALYTICAL CHEMISTRY

WILLIAM T. HALL

Electrometric analysis. WILLI CLAUD. *Metall. u. Erz* 22, 7-12(1925); *J. Inst. Metals* 33, 415.—The theory, principles, app. and review of the subject are given.

E. J. C.

Studies on the precision of volumetric analysis. III. Standards for alkali hydroxide solutions. K. O. SCHMITT. *Z. anal. Chem.* 71, 273-90(1927); cf. *C. A.* 21, 1775.—Oxalic acid and its acid salts have been recommended as standards for bases with phenolphthalein as indicator. If, however, as Bruhns has recommended, the oxalate ion is pptd. by the addn. of Ca^{++} , an equiv. amt. of mineral acid is formed in the soln. and an indicator like dimethyl yellow can be used in place of the phenolphthalein and thereby the carbonic acid error is avoided. Rigorous tests of such a procedure show that with pure oxalic acid or with K tetroxalate, it is, in fact, possible to carry out such titrations with great accuracy but it is necessary to have the soln. almost exactly neutral when pptn. with CaCl_2 is accomplished. A preliminary titration is, therefore, necessary. Directions are given for recrystg. and prepg. pure oxalic acid and K tetroxalate.

W. T. H.

The influence of impurities from the containing glass on the titer of caustic soda solutions (fixanal solutions). K. SEILER. *Schweiz. Apoth. Ztg.* 65, 229-33(1927); cf. *C. A.* 19, 1389; 20, 1188, 1771.—Results of renewed expts. tend to show that deviations between the values obtained with Me orange and phenolphthalein are caused by impurities originating from the glass.

S. WALDBOTT

Methods of expressing strengths of commercial caustic soda and soda ash. ANON. *Analyst* 52, 529-60(1927).—"Newcastle" and "Liverpool" or "New York and Liverpool" degrees and percent Na_2O are often used indiscriminately in the trade. It would be best to drop such terms and report the % Na_2O equiv. to "English test" as per Lunge's tables.

W. T. H.

A simple method for the potentiometric, differential titration. W. A. ROTH. *Z. Elektrochem. angew. physik. Chem.* 33, 127-9(1927).—The method of MacInnis and Jones (*C. A.* 21, 367) is simplified by using a glass-filtering crucible to keep the soln. around the comparison electrode isolated from the bulk of the soln. that is being titrated. Satisfactory elec. connection is made through the sintered glass bottom of the crucible. The method is illustrated by some typical titrations of AgNO_3 with NaCl and of acid with base.

W. T. H.

The use of borax as a standard in acidimetry. T. MILOBEDZKI AND MLEF. H. KAMINSKA. *Bull. soc. chim.* 41, 957-60(1927).—Borax has not been used as much as it deserves for the standardization of acids. To obtain $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$ it is necessary to have the first crystals appear at above 60° from the satd. soln. The use of methyl red as an indicator is recommended and some interesting observations are made with respect to the difficulty of prepg. NaOH solns. absolutely free from carbonate.

W. T. H.

Potassium permanganate as an acidimetric standard. THEODOR HECKZO. *Z. anal. Chem.* 71, 332-8(1927).—To a measured vol. of standard KMnO_4 soln. in an Erlenmeyer flask, add a slight excess of 0.2 N H_2SO_4 and then 2 or 3 times as much H_2O_2 as is theoretically necessary to accomplish the complete reduction of the MnO_4^- to Mn^{++} . After the reduction is complete titrate the excess acid with the base, using a slight excess and finishing the titration by the addition of H_2SO_4 , using methyl red as indicator.

W. T. H.

The use of yellow mercuric oxide and of metallic mercury as standards in volumetric analysis. I. M. KOLTHOFF AND L. H. VAN BERK. *Z. anal. Chem.* 71, 339-49(1927).— HgO can be dissolved in KI or KBr and water and the soln. titrated with HCl . After proper corrections have been applied, the results are within 0.1% of the truth but the method is certainly not as accurate as standardization of an acid against borax. To carry out the standardization, dissolve 1 g. of HgO and 20 g. of neutral KBr in 25 cc. of hot water, add phenolphthalein and titrate with acid until the soln. is colorless. Then add methyl red and finish the titration at the boiling temp. $\text{Hg}(\text{SCN})_2$ is so slightly ionized that a soln. of a mercuric salt can be titrated with KCNS with ferric alum as indicator. At high room temps., however, there is a slight error due to a slight ionization of the $\text{Hg}(\text{SCN})_2$. No correction is needed at 15° but at higher temps. a correction can be made by making use of a satd. soln. of $\text{Hg}(\text{SCN})_2$ having the same vol. and the same content of HNO_3 and ferric salt as the soln. to be titrated. Deduct from the vol. of KCNS used in the analysis, the vol. required to give an end

point with the $\text{Hg}(\text{SCN})_2$ soln. HgO can be used as standard for this titration but it is somewhat better to use redistd. Hg . W. T. H.

The use of indicators: Gillespie's method. F. J. WATSON. *Chem. Eng. Mining Rev.* 19, 381-3(1927).—The theory of the method of G. is outlined and its practical advantages are shown (cf. C. A. 14, 1499, 1797). W. T. H.

New indicators in argentometry. O. TOMIČEK. *Časopis Československého Lékařnictva* 5, 1-3, 15-6; *Chem. Zentr.* 1926, II, 269-70. Argentometric detns. of chlorides, bromides and iodides according to Mohr and Volhard and in the presence of fluorescein and eosin according to Fajans and Wolf are compared. The Volhard and Fajans methods give practically the same results. In titrations of bromides and particularly of iodides, the Fajans method gives a more distinct end point and is more precise than the Mohr method. For important pharmaceutical detns. of alkali chlorides, bromides and iodides, the method of Fajans is recommended. C. C. DAVIS

Note on cobalt thiocyanate as a microchemical reagent. JUSTIN GREGER. *Biochem. Z.* 185, 438-41(1927).—A 20-40% soln. of $\text{Co}(\text{SCN})_2 \cdot 2\text{H}_2\text{O}$ is recommended. The $\text{Co}(\text{SCN})_2 \cdot 2\text{H}_2\text{O}$ is prepd. by mixing a concd. soln. of CoSO_4 with an alc. soln. of KSCN and evapg. carefully when the substance seps. as blue crystals. The soln. is a very valuable reagent in the examn. of flours and foodstuffs. It dissolves the water-sol. portions of starch while the tissues become clarified and variously colored. S. M.

The effect of gelatin on titration curves of various acids. ERNEST LITTLE. *J. Am. Pharm. Assocn.* 16, 414-7(1927).—Various acids were titrated in the presence of and in the absence of gelatin. Curves were constructed for each class. The curves show surprisingly little effect due to the gelatin. L. E. WARREN

The use of chromate solutions for comparison in colorimetric determinations. HOLGER JØRGENSEN. *Biochem. Z.* 186, 485-9(1927).—Dil. aq. solns. of chromate and dichromate do not have a definite color tone and cannot therefore be used either as H-ion indicators or as colorimetric standards. However, if a buffer of definite p_H is used as the solvent in place of H_2O , the chromate and dichromate solns. assume definite color tones, and these may find varied use in colorimetric work. S. M.

Investigation of the green solutions of potassium chrome alum with respect to the specific gravity. M. A. RAKUZIN AND ADELHEID ROSENFELD. *Chem.-Ztg.* 51, 638(1927).—The d. of the green soln. of chrome alum was detd. at different intervals from a content of 5% to that of the satd. soln. contg. 114.2% of the wt. of solvent. At 5% the d. is 1.0378 at 20° and of the satd. soln. it is 1.6683. Because of the effect of hydrolysis the increase in d. is not perfectly regular. W. T. H.

Spectrum analysis in metallurgy; some further notes. J. R. GREEN. *Chemistry and Industry* 46, 745-6(1927).—For the detn. of small quantities of certain elements, spectral analysis is invaluable and when properly carried out the results agree with those obtained by the ordinary methods of wet analysis. W. T. H.

Experimental researches on quantitative spectral analysis of metallic alloys. TRAJAN NEGRESCO. *Séparate*, Les Presses Universitaires de France, Paris 1927, 120 pp.—This most exhaustive study of the various factors concerned in the production of suitable spectra shows to what extent the analytical chemist can make use of spectral analysis in detg. the constitution of alloys. The sources of error are pointed out and the theoretical aspects discussed. W. T. H.

Analytical commission of the platinum institute. I. Instructions for the reception of platinum ore. S. F. ZHEMCHUZHNI, O. E. ZVYAGINTZEV, B. G. KARPOV, V. V. LEBEDINSKII AND N. I. PODKOPAEV. *Ann. inst. platine* 1926, No. 4, 339.—(1) Two g. of ore are melted with 7-10 g. pure Ag and flux to remove V, W, Fe, etc. (2) At the same time Ag and Pb are dissolved by HNO_3 and estd. (3) A mixt. of HF and HNO_3 is used to dissolve W which is separately detd. The operations require 1 hr. II. **Method of rapid analysis of platinum ore.** S. F. ZHEMCHUZHNI, O. E. ZVYAGINTZEV, B. G. KARPOV, V. V. LEBEDINSKII AND N. I. PODKOPAEV. *Ann. inst. platine* 1926, No. 4, 340-3.—Details are given for the above procedure. III. **Method of analysis of platinum ores.** IV. **Method of analysis of platinum ores for copper and iron.** V. **Method of complete analysis of platinum ore.** A. T. GRIGORIEV, S. F. ZHEMCHUZHNI, O. E. ZVYAGINTZEV, B. G. KARPOV, N. S. KURNAKOV, V. V. LEBEDINSKII AND N. I. PODKOPAEV. *Ann. inst. platine* 1926, No. 4, 343-55.—Dissolve in aqua regia, filter, evapg. the filtrate with HCl , dil. with H_2O , introduce Cl_2 at 40° (to form IrCl_4 and prevent reduction of Au), evapg. at 38-42°, dil. and ppt. at 30° with NH_4Cl (Pt and Ir in ppt.). To a portion of the filtrate add dimethylglyoxime in boiling water (Au and Pd in ppt.). Reduce the new filtrate with Zn and HCl (Cu, Rh, rest of Ir in ppt.). The last filtrate contains Fe, which may be pptd. as the hydroxide. To the filtrate from the pptn. of Pt and Ir by NH_4Cl add concd. HNO_3 (to decompose NH_4Cl), dissolve

the residue in water and digest at 80–100° with alkaline NaNO_2 . The ppt. consists of gold and non-noble metals. Evap. the filtrate, contg. Rh, Ir, Ru, Pt and Pd with HCl to remove HNO_3 , ppt. the Pd by $\text{Hg}(\text{CN})_2$ and the rest of the Pt and Ir by NH_4Cl , then all the metals with Zn. Remove the Zn and redissolve in aqua regia, pptg. the Ir with NH_4Cl and again reducing the filtrate with Zn to get Rh. All Ir ppts. are reduced to metal which is melted with soda and dissolved in dil. HCl. Ir oxide remains as ppt., while Ru goes into soln. and may be sepd. by Zn. VI. Method of analysis of first insoluble residue obtained on dissolving platinum ore with aqua regia. S. F. ZHEMCHUZHNI, O. E. ZVYAGINTZEV, B. G. KARPOV, V. V. LEBEDINSKII AND N. I. PODKOPAEV. *Ann. inst. platine* 1926, No. 4, 355–9.—Treat the ppt. with boiling NH_4OAc and NI_3 soln. to remove PbSO_4 and AgCl , then melt with pptd. Ag and borax. Dissolve the Ag from the Ag residue with H_2SO_4 and melt the Os-Ir residue with Zn in a H atm. or under a mixt. of KCl and NaCl. Dissolve the melt in water, add HNO_3 and HCl and distil OsO_4 . Neutralize the residue with NaOH in excess and distil Ru in a stream of Cl with further additions of NaOH. The Ru is worked up by pptn. with Mg. After the distn. of the Ru acidify the residue, filter, oxidize the filtrate with Cl and ppt. with NH_4Cl , continuing as in the general method for small amts. of Ir, Pd and in the final filtrate for Rh, pptd. by Zn, melted and cooled in a stream of CO_2 . WILLIAM M. MALISOFF

Determination of carbon in iron and steel by the barium hydroxide method. GUSTAV THANHEISER and PRYTER DICKENS. *Mitt. Kaiser-Wilhelm Inst. Eisenforsch. Düsseldorf* 9, 239–45 (1927).—An app. is shown which is especially suited for the analysis of low-C materials but is suitable for other materials contg. more C. The app. can be used for the gravimetric detn. of C as BaCO_3 or for the titration of the BaCO_3 ppt. The results shown agree well even when as little as 0.005% of C is present.

W. T. H.

New method of quantitative analysis applicable to a mixture of rare earths. EUGENE DELAUNEY. *Compt. rend.* 185, 354–7 (1927).—The variation of the breadth of the absorption bands in the visible spectra can be used to det. certain elements. Thus with solns. contg. Nd or Pr curves can be constructed showing how broad the bands should be for a given content of the element.

W. T. H.

The evolution of mineral substances and the analytical applications. A. JOUNIAUX. *Bull. soc. chim.* 41, 905–19 (1927).—A discussion of the various stages which a substance undergoes in nature before stable crystals are formed, with the idea that an exact knowledge of the principles underlying such transformations ought to be helpful to the analytical chemist.

W. T. H.

The analysis of silicate slags. T. P. COLCLOUGH. *J. Soc. Glass Tech.* 11, 177–84 (1927).—The high content of bases in slags increases the danger of dehydrating SiO_2 at temps. above 105°. The sample of slag is moistened with H_2O and heated to boiling before adding HCl and a little HNO_3 . Fe_2O_3 , Al_2O_3 and P_2O_5 are pptd. by NH_4OAc , the Mn being detd. as Mn_3O_4 in the filtrate after the addn. of Br $_2$. The estn. of CaC_2O_4 by titration with KMnO_4 is considered better than ignition and weighing as CaO. P_2O_5 is detd. on a fresh 0.5 g. sample. After the removal of SiO_2 , NH_4OH is added to the filtrate until the $\text{Fe}(\text{OH})_3$, etc., just begins to ppt. and then 2–3 cc. excess. The soln. is boiled. HNO_3 is added until the ppt. is almost dissolved and then 12 cc. in excess. The soln. is cooled to 75° and 40 cc. of a 10% soln. of neutral NH_4 molybdate are added. After settling the yellow ppt. is weighed and calcd. to P_2O_5 by the factor 0.377. S may be present both as sulfide and SO_4 . The sulfide S can be expelled by boiling the sample with HCl. It is recommended that the BaSO_4 ppt. be allowed to stand 24 hrs. before filtering. For rapid control method for blast-furnace slag the CaO is detd. in the filtrate from the SiO_2 , $\text{Al}(\text{OH})_3$, $\text{Fe}(\text{OH})_3$, etc., ppt. together. For open-hearth slags the detn. of the FeO by titration in the sample dissolved in 1:3 H_2SO_4 and some HF serves as an index of the slag condition. For elec. furnace slags the KSCN colorimetric method is suggested for total Fe.

H. F. K.

The analysis of fluorspar. BRAUER and RUTHSATZ. *Chem.-Ztg.* 51, 618–9 (1927).—Drawe (C. A. 19, 2613) recommended a method which is essentially that used by B. and R. for some years and depends upon the indirect detn. of the F combined with Ca. The method is good but if BaSO_4 is present, as frequently happens, boiling with Na_2CO_3 will lead to the erroneous conception that all of the SO_4 comes from CaSO_4 . Also in the residue, the Ca cannot be detd. in such a case without prior removal of Ba. The direct detn. of F by treatment with SiO_2 and H_2SO_4 with volatilization as H_2SiF_6 , although not altogether accurate, is better than not to det. F at all.

W. T. H.

New methods for the determination and separation of metals with the aid of 8-hydroxyquinoline. IV. Determination and separation of cadmium. R. BERG. *Z.*

anal. Chem. **71**, 321-31(1927); cf. *C. A.* **21**, 2630.—The difficult soly. of the compds. of Cu, Zn and Cd with 8-hydroxyquinoline in dil. AcOH solns. permits the sepn. of these cations from Mg^{++} . The same principle permits the sepn. of Cu and Cd since the latter is not pptd. if the AcOH content is increased. In caustic alkali solns., Cd can be sepd. from cations other than those mentioned above, by pptn. with 2-hydroxyquinoline. **V. Determination and separation of aluminum.** *Ibid.* 369-80.—The presence of org. material often makes the detn. of Al difficult by the usual methods and the same is true of the presence of other cations whose salts are easily hydrolyzable. By the reagent, 8-hydroxyquinoline, however, Al can be pptd. even in tartrate solns. The resulting Al ppt. differs from the quinoline salts of Cu, Mg, Zn and Cd by being readily sol in NaOH solns. and unlike Mg, a ppt. is obtained in the presence of dil. AcOH. The Al ppt. can be weighed after drying at 110° or it can be ignited together with oxalic acid and weighed as Al_2O_3 . It is also accurate to det. the hydroxyquinoline in the ppt. by bromometric titration as in the case of the corresponding Zn and Cd ppts. The ppt. has the formula $Al(C_8H_6ON)_3$. W. T. H.

Micro-determination of metals in salts. H. I. COOMBS. *Biochem. J.* **21**, 404-6(1927).—A Pt cylinder surrounds the boat in which the combustion is made. The cylinder and boat are boiled in HNO_3 (1:5), ignited, cooled and weighed. Four to five mg. of the substance to be analyzed is weighed into the boat and moistened with 2-3 drops of H_2SO_4 (1:5). For the combustion, a transparent silica tube is supported on a combustion stand. An aspirator with a bubbler supplies the air. The cylinder, with the tube in it, is first dried and then put into position. Air is turned on and the flame slowly advanced to the center of the cylinder, wire gauze being used to conduct the heat. After a time the gauze is removed and the full flame of the burner is allowed to play on the silica tube. The air is gradually replaced by O and at the end of 3 min. strong heating in the gas, the cylinder is removed, cooled and weighed. B. H.

The determination and separation of rare metals from other metals. VIII. Determination of thallium as thallous (I) chromate and its separation from other metals. LUDWIG MOSER AND ALFRED BRUKL. *Monatsh.* **47**, 709-25(1927); cf. *C. A.* **21**, 716.—Usually Tl has been detd. as TlI but evidence is now produced which shows that the detn. as Tl_2CrO_4 is more satisfactory. Heat the ammoniacal soln. of thallous salt to boiling and add, while stirring, enough K_2CrO_4 to make the soln. contain 2% of this salt. Allow to stand overnight and wash by decantation with 1% K_2CrO_4 soln. and finally with 50% alc. Dry the ppt. at 120° and weigh as Tl_2CrO_4 . For many of the sepns. described the use of pure sulfosalicylic acid, to form sol. complex salts with Tl, is advised. To purify the com. acid, prepare a satd. soln. in 96% alc. and filter through asbestos after standing several days. *To sep. Pb from Tl*, first add a few drops of H_2SO_4 and boil off excess SO_2 , to make sure that all Tl is univalent. Add 20 cc. of 33% sulfosalicylic acid and an excess of $(NH_4)_2HPO_4$ soln. Make slightly ammoniacal and after some hrs. filter off the cryst. $Pb_3(PO_4)_2$. Wash with very dil. NH_4OH contg. some NH_4NO_3 and ignite the ppt. to dull redness before weighing. Conc. the filtrate by evapn., make slightly ammoniacal and det. the Tl as above. *To sep. Mn from Tl*, proceed similarly but ppt. the Mn as $MnNH_4PO_4$ and weigh as $Mn_2P_2O_7$. *To sep. Tl from Al*, prepare a soln. with sulfosalicylic acid as above but in this case det. the Tl first as chromate. In the filtrate destroy the org. acid and then det. the Al as usual. *To sep. Tl from Fe*, proceed similarly but add 10 cc. of sulfosalicylic acid for each 0.1 g. of Fe_2O_3 present. On boiling the dark violet color of the Fe soln. turns red but the Tl can be pptd. as chromate without contamination. *To sep. Tl from Cr*, proceed as with Al. *To sep. Tl from Zn*, heat the soln. to 60° and add NH_4OH until the basic Zn ppt. dissolves completely. Then ppt. the Tl as chromate. *To sep. Tl from Cd*, proceed as with Zn but in the filtrate from the Tl_2CrO_4 pptn. det. the Cd as CdS rather than as $CdNH_4PO_4$. *To sep. Tl from Ni*, add concd. NH_4OH to the soln. dropwise until all the Ni ppt. has dissolved, heat to 60° and det. the Tl as chromate. If much Ni is present use an aliquot part of the filtrate for the dimethylglyoxime pptn. *To sep. Tl from Co*, proceed similarly but carry out the work in an atm. free from H_2S . Drive off the NH_3 from the filtrate from Tl_2CrO_4 and ppt. the Co with KOH and Br_2 . *To sep. Tl from Ag*, treat the slightly ammoniacal soln. either with KCN or $Na_2S_2O_3$ and ppt. the Tl as chromate. To the filtrate, add $Na_2S_2O_3$, if not already present, make strongly acid and ppt. the Ag as Ag_2S by boiling. *To sep. Tl from Hg*, proceed similarly but avoid an excess of KCN. *To sep. Tl from Cu*, proceed as with Ag but first add sufficient NH_4OH to give a clear blue soln. *To sep. Tl from Bi*, dil. the soln. until about 0.1 g. Bi is present in 100 cc., heat to boiling and add $(NH_4)_2HPO_4$ to ppt. $BiPO_4$. Filter and det. Tl in the filtrate as Tl_2CrO_4 . *To sep. Tl from As*, it is best to add KBr to the HCl soln. and distill off the As. *To sep. Tl from Sb*, oxidize the Sb in ammoniacal

soln. with H_2O_2 which does not affect Ti(I) even at 100° and ppt. the Ti as chromate. *To sep. Ti from Sn* , neutralize the acid soln. with NH_4OH , first reducing with KCN if any thallic salt is present, make acid with a little AcOH , add some NH_4NO_3 , dil. to 500 cc. and boil. Filter off the Sn ppt. and weigh as SnO_2 after igniting. Conc. the filtrate and det. Ti as chromate. *To sep. Ti from Se* , ppt. Ti_2CrO_4 from an ammoniacal soln. and det. Se in the filtrate after pptn. with $\text{NH}_4\text{OH.HCl}$. W. T. H.

Rapid method for the separation of silver and lead by the potentiometric method. ERICH MÜLLER AND HERBERT HENTSCHEL. *Z. anal. Chem.* 72, 1-5(1927).—It takes but a few min. to det. both Ag and Pb potentiometrically. First, using a Ag indicator electrode, titrate the Ag with NaCl soln. and then, using a Pt indicator electrode, titrate the Pb with ferrocyanide soln. W. T. H.

The titrimetric determination of bismuth. WILHELM STRECKER AND ALFRED HERRMANN. *Z. anal. Chem.* 72, 5-14(1927).—Two methods by which Bi can be detd. accurately are given. In the first method, the dil. Bi soln. in the presence of a very little HNO_3 is treated with an excess of standard Na_2HPO_4 to ppt. BiPO_4 . The soln. is neutralized and the excess PO_4^{---} pptd. with a known vol. of standard AgNO_3 and the excess of Ag is titrated with KCNS ; ferric alum is used as indicator. In the second method, Bi is pptd. as metal by means of Mg and the metal is dissolved out of contact with air by an acid soln. contg. ferric salt. The amt. of ferrous Fe formed is finally titrated with KMnO_4 . W. T. H.

A new sensitive test for bismuth. H. KUBINA AND J. PLICHTA. *Z. anal. Chem.* 72, 11-4(1927).—Dimethylglyoxime, so widely used as a precipitant of Ni , also gives a sensitive reaction with Bi solns. Thus if a chloride or nitrate soln. contg. Bi is treated with 1% dimethylglyoxime and then NH_3 is added to strongly alk. reaction, all of the Bi is pptd. as yellow, very voluminous Bi oxime. Attempts to det. Bi by this method were unsuccessful because of the tendency for Bi to form basic salts on diln. W. T. H.

The spectral determination of lead in bismuth. EUGEN SCHWEITZER. *Z. anorg. Chem.* 165, 364-70(1927).—By the spectrographic study of homologous lines in emission spectra it is easy to det. with considerable accuracy the quantity of Pb in Sn or in Bi . A table given shows the results with 0.6-10% of Pb in these 2 metals. W. T. HALL.

Detection of chromium by oxidation with bromine or with chlorine in the presence of silver nitrate. R. POSNER. *Z. anorg. allgem. Chem.* 164, 407-8(1927); cf. C. A. 21, 1605.—The test given succeeds in the presence of considerable Fe or Mn and Cl_2 aq. better than with Br_2 . To 5 cc. of 2 N AgNO_3 add 1 cc. of Cl_2 aq. and 0.5 cc. of the soln. to be tested. Boil 1 min. and then make slightly ammoniacal with 2 N NH_4OH . Filter and very carefully neutralize with 2 N HNO_3 . If more than 0.5 mg. of Cr is present per cc., a ppt. of Ag_2CrO_4 is formed at once. If 0.5-0.1 mg. of Cr is present per cc., a ppt. of Ag halide is formed and gradually the soln. becomes orange in color; the color disappears on adding more HNO_3 . W. T. H.

New cobalt reaction. PIETRO FALCIOLA. *Giorn. chim. ind. applicata* 8, 612 (1926).— $\text{Na}_2\text{S}_2\text{O}_4$ is a sensitive specific reagent for Co when added in the cold (solid or dissolved) to the soln. under examn., previously rendered strongly ammoniacal; there develops, according to the concn. in Co ion, a color that goes from yellow to orange, to ruby-red or to a dark red; finally a brown-black ppt. may form. The blue color of ammoniacal Ni solns. is not changed by the reagent. The color develops little by little in the neighborhood of the reagent and extends from it; in this way Co may be detected in the HCl soln. of the sulfides of the 4th group metals. If much Co is present with the Ni , the ammoniacal liquid gives a violet instead of a pure blue color. Decolorization may be brought about, preferably in the hot, by HCHO , which brings back the green color of the nickelous ion. H_2O_2 destroys the characteristic reddish yellow tint. Tartaric, citric and formic acids, if they do not hinder the test, attenuate it considerably. $\text{Na}_2\text{S}_2\text{O}_4$, added in the solid form to a Co soln. in an ammoniacal medium in presence of the common metals and also Mo , U , V , W and Ti , gives after some time a transition in tint to a brownish red; the filtrate shows a reddish yellow color which may be deepened by addn. of more hyposulfite. ROBERT S. POSMONTIER.

Contribution to the study of ruthenium. XI. A volumetric estimation of ruthenium. J. L. HOWE. *J. Am. Chem. Soc.* 49, 2393-5(1927); cf. C. A. 21, 3843.—Finely divided Ru can be dissolved in alk. NaClO soln. and from such soln., after treatment with Cl_2 , RuO_4 can be distd. If the distillate contg. RuO_4 is condensed in cold, concd. HCl , H_2RuCl_6 is formed. After boiling off excess Cl , the soln. can be titrated with 0.05 N SnCl_2 soln. W. T. H.

A rapid method for the determination of nickel. G. SPACU AND J. DICK. *Z. anal. Chem.* 71, 442-6(1927).—If a neutral soln. of Ni is treated with pyridine and an

alkali thiocyanate, the Ni is pptd. completely as $\text{Ni(Py)}_4(\text{SCN})_2$. This ppt. can be filtered, washed, dried in a vacuum and weighed, within about 30 min. As wash liquids the following 4 solns. are recommended: (1) Four g. of NH_4CNS and 6 cc. of pyridine in 1 l. of water, (2) 370 cc. of 95% alc., 615 cc. of alc., 15 cc. of pyridine and 1 g. NH_4CNS , (3) 5% pyridine soln. in abs. alc., (4) ether contg. 2 drops of pyridine in each 20 cc. To 100 cc. of Ni soln. add 0.5-1.0 g. of NH_4CNS , heat to boiling and ppt. with 1-2 cc. of pyridine. Filter, wash, dry in a vacuum at room temp. and weigh. The ppt. contains 11.95% of Ni.

W. T. H.

Substitution of sodium compounds for potassium compounds. A. R. SMITH AND F. C. VILBRANDT. *J. Elisha Mitchell Sci. Soc.* **42**, 118-21 (1926).—Comparative detns. using Na and K compds. side by side were made in about 200 different technical methods of analysis. NaMnO_4 , $\text{Ba}(\text{MnO}_4)_2$ and $\text{Ca}(\text{MnO}_4)_2$ may be used interchangeably instead of KMnO_4 in all detns. for which the latter is commonly used with identical results. NaI , NaOH , Na_2CrO_4 , $\text{Na}_2\text{Cr}_2\text{O}_7$, NaCN , Na_2S , Na_2SO_4 , NaNO_3 , NaClO_3 and $\text{NaFe}(\text{CN})_6$ may also be substituted for the corresponding K compds. in such analytical methods as commonly use the latter. Alc. NaOH gave the same results as alc. KOH for detg. Me esters in menthol and for the sapon. nos. of animal and vegetable fats and oils and lubricating oils but not for the sapon. nos. of beeswax or rosin. In the last two detns. similar but not identical results were obtained.

A. L. M.

A titrimetric determination of potassium. G. JANDER AND O. PFUNDT. *Z. anal. Chem.* **71**, 417-34 (1927).—The method depends upon the detn. of the satn. point by the conductometric method using a cold, concd. soln. of K salt and titrating with a concd. soln. of NaClO_4 . Instead of a telephone the use of a thermo-cross is recommended which is connected to a galvanometer.

W. T. H.

The transformation of alkali chlorides to carbonates by the action of oxalic acid. L. N. MURAVLEV. *Z. anal. Chem.* **72**, 15-9; *Z. anorg. allgem. Chem.* **165**, 137-41 (1927).—An attempt was made to det. Na and K by heating the chlorides with oxalic acid and weighing the resulting carbonates. It was found, however, that the conversion to carbonates was incomplete unless the heating was continued until every vestige of C was consumed and the method is not to be recommended.

W. T. H.

Color test for magnesium. W. J. PETRASCHENJ. *Z. anal. Chem.* **71**, 291-7 (1927).—If dil. NaOH is added to I_2 soln., the color of the latter fades and when the soln. is decolorized it is probable that NaIO is formed. When such a soln. is added to an aq. soln. contg. Mg^{++} a colored ppt. is obtained which may be $\text{Mg}(\text{OH})_2$ and adsorbed I_2 or else it is $\text{Mg}(\text{IO})_2$. If considerable NaOH is present, the ppt. is colorless. The presence of NH_4^+ tends to prevent pptn.

W. T. H.

Determination of manganese and magnesium in aluminum alloys. FRANZ MUGRAUER. *Chem.-Ztg.* **51**, 658 (1927).—Det. the Mn in the usual way by the permanganate method of Volhard and in the filtrate det. Mg by pptn. as MgNH_4PO_4 in the presence of considerable NH_3 which will keep Zn in soln.

W. T. H.

Criticism of some methods for determining magnesium and calcium. A. TERESHCHENKO AND M. NEKRICH. *Ukrainskii Khim. Zhurnal* **2**, 163-72; *Chem. Zentr* **1926**, II, 2464-5. A study of the citrate method showed that the pptn. of Mg in the presence of citric acid is never quant. In the absence of other cations the result is low and in the presence of Ca and other metals it is too high. Diln. of the soln. reduces the co-pptn. of Ca. NH_4Cl accelerates and citric acid retards the settling of the ppt. Likewise the volumetric detn. of Mg as $\text{MgNH}_4\text{AsO}_4$ followed by iodometric titration is unsatisfactory. In the absence of other metals, however, the iodometric method can be used with success if it is modified by dissolving the $\text{MgNH}_4\text{AsO}_4$ in dil. H_2SO_4 , reducing the soln. with SO_2 , expelling the excess SO_2 on the water bath, neutralizing and titrating with I.

C. C. DAVIS

Substitution of centrifugation for filtration and calcination in the gravimetric estimation of tin and lead in their alloys. MICHELE FOA. *Giorn. chim. ind. applicata* **9**, 69-70 (1926).—For alloys low in Sn: Treat 5 g. of the finely divided sample with 30 cc. 1.4 HNO_3 in a covered beaker on the sand bath. After the attack has begun, add drop by drop along the walls, 15 cc. H_2O and allow the attack to finish (about 15 min.). Transfer liquid and ppt. to a previously tared centrifuge tube, washing the soln. beaker carefully with 50 cc. boiling H_2O . Stir the liquid in the tube to dissolve the sepd. $\text{Pb}(\text{NO}_3)_2$. Centrifuge for 3 min. at 3000 r.p.m. Stop the centrifuge slowly and avoid jarring. Decant the supernatant soln. carefully, add 70 cc. boiling H_2O and stir well to pulverize completely the deposit adhering to the glass. Repeat centrifugation and decantation until a drop of the centrifuged liquid on KI paper ceases to indicate Pb. Dry at 110° to const. wt. Collect all the decantations, bring to 500 cc., take 50 cc., ppt. the Pb with 2-3 cc. 1.84 H_2SO_4 and sep. the PbSO_4 by the centrifuge as

above described for Sn. For alloys high in Sn, treat 0.5 g. sample with 12 cc. hot 1.2 HNO_3 ; after 10 min. transfer to the centrifuge tube, and proceed as above described. The results are satisfactory, with great economy in time. R. S. P.

New method for determining copper in chemically treated cloth. BONNARD AND LEBLANC. *Ann. chim. anal. chim. appl.* 9, 233-5(1927).—The Artillery Service of France frequently has to test cloth that has been impregnated with Cu salt to prevent formation of mildew. Cut the cloth into small pieces, ignite and fuse the ash with $\text{Na}_2\text{S}_2\text{O}_7$. Take up in 200 cc. of hot water, add a few drops of HCl and ppt. the Cu with H_2S . Filter, ignite to CuO, dissolve in HNO_3 and det. by electrolysis or by KCN titration. W. T. H.

Determination of lithium in "scleron" metal and in similar aluminum alloys. E. SCHÜRMANN AND W. BÖHM. *Chem.-Ztg.* 61, 677-8, 698-9(1927).—Next to duralumin, scleron metal is one of the best known Al alloys in Germany and contains, besides the usual constituents, a little Li. The Al content varies from 85 to 95% and there is usually about 0.1% Li. Two methods are described for the detn. of Li. The first depends upon the removal of most of the Al as chloride, pptn. of the Cu and Zn as oxalates, pptn. of the Cu by electrolysis before a second oxalate pptn., removal of the last traces of Zn by H_2S , removal of the last traces of Al, etc., with NH_4OH and H_2O_2 , examn. of this ppt. for Li after making a basic acetate pptn. by converting the sulfate soln. to chloride by successive treatments with $\text{Pb}(\text{OAc})_2$, H_2S and HCl and finally detg. as LiCl by the method of Gooch using amyl alc. For the analysis, 20 g. should be taken. The second method depends upon the pptn. of all interfering cations by treating the HCl soln. of the alloy with an excess of freshly pptd. Ag_2O or Ag_2CO_3 . The first ppt. may contain a little Li which can be removed easily by repeating the pptn. Good results can also be obtained by finally sepg. the Na from Li by Carnot's fluoride method, making an allowance for the soly. of LiF in dil. NH_4OH . W. T. H.

A nephelometric method for determining small quantities of arsenic. I. A new turbidity reagent and the behavior of the turbidities produced with arsenic acid. HANS KLEINMANN AND FRITZ PANGRITZ. *Biochem. Z.* 185, 14-43(1927).—The reagent recommended consists of equal parts of 1% K_2MoO_4 soln. and 2% cocaine soln. and 2 parts of N HCl. It gives a turbidity with small quantities of As_2O_3 and the turbidity is quite stable after the max. d. has been reached. The presence of NaCl or of Sb does no harm but H_3PO_4 must be absent. By the nephelometric procedure as little as 1×10^{-6} mg. of As can be detd. II. The determination of arsenic in any material. *Ibid.* 44 62.—Org. matter must first be destroyed by incineration or treatment with concd. HNO_3 . Directions are given in detail for the treatment of an organ of the body, eventually distg. off the As as AsCl_3 , collecting the distillate in N NaOH, oxidizing the As with perhydrol and using an aliquot part of the entire distillate for the nephelometric test. S. MORGULIS

Analysis of antimony alloys. H. VIGNAL. *Ann. chim. anal. chim. appl.* 9, 193-6 (1927).—For the analysis, use about 1 g. of alloy for the detn. of all metals except Sn and use 1.2-3 g. for the detn. of Sn alone. Dissolve the first sample in a mixt. of 40 cc. of 50% tartaric acid soln. and 15 cc. of HNO_3 . Heat gently and shake from time to time. If a clear soln. is not obtained in about 10 mins., this indicates the presence of considerable Sn and a fresh sample should be taken and more tartaric acid used. To the soln. add 10 cc. of 18 N H_2SO_4 and about 15 cc. of water. Let stand 12 hrs., filter off the PbSO_4 and weigh in the usual manner. A few mg. of Pb will remain in soln. Add an excess of NaOH to the filtrate from the PbSO_4 pptn. until the soln. is blue and then add 20 cc. of NaOH soln., d. 1.3, in excess. Boil and add about 0.5 g. of lactose. Boil a little longer, filter and calcine the Cu ppt. To the filtrate from the Cu_2O pptn., add H_2S to ppt. traces of Pb and Cu that remained dissolved. Calcine this ppt. together with the above Cu_2O ppt. Dissolve the ignited ppt. in 15 cc. of HNO_3 and det. Cu and the residual Pb electrolytically. Fe and Zn can be detd. in the filtrate from the H_2S pptn. in the usual way. The alk. soln. from which the last traces of Cu and Pb were removed with H_2S contains all the Sn and Sb. Add H_2SO_4 until the Sb and Sn ppt. that forms where the soln. is acid dissolves with difficulty on mixing. Then add 30 g. of oxalic acid, boil about 2 hrs. and ppt. the Sb with H_2S . Dissolve the ppt. in HCl and KClO_3 , boil off the excess Cl_2 , cool, add 2-3 g. of KI and titrate the liberated I_2 (equiv. to the Sb) with $\text{Na}_2\text{S}_2\text{O}_3$. For the Sn detn. treat with HNO_3 and filter off the resulting metastannic acid after the usual dehydration. Fuse the ignited oxide with NaOH, take up the melt in dil. HCl, heat in a flask, which is connected with a reflux condenser, with about 1 g. of piano wire until the Sb is deposited as metal and the Sn is all in the bivalent state. If necessary add a little SbCl_3 and more Fe. After the Fe has all dissolved, filter, wash rapidly and titrate with KMnO_4 . Each drop of

KMnO₄ forms yellow FeCl₃ which disappears with the formation of SnCl₄ as long as there is any SnCl₂ remaining unoxidized. The end point is, therefore, the formation of a permanent yellow coloration. W. T. H.

Detection of traces of iron in volatile and combustible substances. ERNEST KAHANE. *Ann. chim. anal. chim. appl.* 9, 196-8(1927).—Ignite the substance, or evap. the soln. to dryness. Treat the residue on white porcelain enamel with 1 drop of 50% NH₄CNS soln. and 1 drop of 10% H₂SO₄. A red color is produced when only a trace of Fe is present. W. T. H.

The analysis of irons and steel. Determination of silicon, phosphorus and silicon. M. MARQUEYROL AND L. TOQUET. *Ann. chim. anal. chim. appl.* 9, 225-33(1927).—Treat 10 g. of the metal with 0.5 g. of KClO₃ and 80 cc. of concd. HNO₃ added in 15-cc. portions. If the metal is not attacked well, add all of the HNO₃ at once and introduce the chlorate in small portions. If the reaction is violent, wait before adding a second portion of HNO₃ and add 0.1-0.2 g. of KClO₃ with each 10 cc. of HNO₃. Evap. to dryness and take up the residue in 100 cc. of concd. HCl. Evap. to dryness again, moisten the residue with 30 cc. of concd. HCl, heat till dissolved and dil. with 150 cc. of water. Filter off the SiO₂, which is reasonably pure in the case of steels but with cast Fe, it should be digested with 40-50 cc. of concd. HCl and eventually tested with HF and H₂SO₄. Dil. the filtrate from the silica to exactly 500 cc. and use a 100-cc. aliquot part for the detn. of P, 250 cc. for the detn. of S and 150 cc. for the detn. of Mn. For the P detn. it is recommended to ppt. with molybdate in the usual manner and then, after a purification treatment with different wash liquors, weigh the ammonium phosphomolybdate after drying at 100° for at least 2 hrs. The S detn. as BaSO₄ follows conventional lines but numerous notes are added to the already voluminous literature on this subject. For the Mn detn. evap. the soln. repeatedly with HNO₃, ppt. with KClO₃ as in the Ford-Williams method, dissolve the MnO₂ in a known vol. of H₂O₂ standard soln. and titrate the excess with KMnO₄. W. T. H.

The separation of vanadium from tungsten. S. G. CLARKE. *Analyst* 52, 466-9 (1927).—V can be sepd. from W by cupferron pptn. if 10 cc. of HF is added, the soln. is neutralized with NH₄OH, made acid with 20 cc. of HCl and dild. to 300 cc. before adding the cupferron. In the analysis of steel the ignited WO₃ ppt. commonly contains a little V, which can be recovered as follows: Dissolve the WO₃ in NaOH soln., filter off the undissolved Fe₂O₃, dissolve it in HCl and add this to the main soln. To the filtered NaOH soln. contg. the W, add HF, NH₄OH and HCl and ppt. the V in it by adding cupferron. W. T. H.

Investigations into the analytical chemistry of tantalum, columbium and their mineral associates. VII. The precipitation of tungstic acid by tannin. VIII. The separation of tungsten from tantalum and columbium. W. R. SCHOLLER AND C. JAHN. *Analyst* 52, 504-14(1927); cf. *C. A.* 21, 1073.—Up to now, cinchonine-HCl has been the reagent most used for effecting the complete pptn. of tungstic acid from acid solns. but it is here shown that tannin can be used to ppt. the WO₃ that escapes pptn. by boiling the acid soln. and adding alkaloid. In the following directions, the cinchonine and tannin pptns. are carried out practically at the same time, so that all the W is pptd. in one operation. Neutralize the alkali tungstate soln. (contg. alkali chloride which usually interferes with the pptn. of H₂WO₄ but is beneficial with the new procedure) with dil. HCl until the bicarbonate stage is reached (neutral to phenolphthalein but basic to methyl orange) and add a freshly prepd. soln. of 0.5 g. tannin in water. A part of this flocculates as a white ppt. if the Cl⁻ content of the soln. is high. Add more dil. HCl until the soln. is acid to litmus paper, when the insol. W complex will be seen. Boil a few min. and then add 5 cc. of 5% cinchonine-HCl soln. dild. somewhat. Boil 5 min. longer and let stand at least 6 hrs. before filtering, igniting and weighing in the usual manner, making use of filter paper pulp in filtering and washing with 5% NH₄Cl soln. contg. a little tannin. For the sepn. of W from Ta and Nb, the following methods are shown to be unreliable: (1) extn. of the ppt., obtained by hydrolysis after K₂S₂O₇ fusion, with NH₄OH or (NH₄)₂S (Berzelius); (2) pptn. of the soln. of K salts by boiling with NH₄NO₃; (3) fusion of the oxides with Na₂CO₃ and S (Rose). A new method of sepn. is proposed which depends on the fusion of the mixed oxides with K₂CO₃, pptn. of the resulting aq. soln. with NaCl, recovery of the small quantity of non-pptd. earth acid by hydrolysis in bicarbonate soln. and pptn. of the W in the filtrate by tannin and cinchonine. W. T. H.

An investigation of the reaction of aluminum with the ammonium salt of aurintricarboxylic acid under different experimental conditions and its application to the determination of aluminum in water. J. H. YOE AND W. L. HILL. *J. Am. Chem. Soc.* 49, 2395-2407(1927).—Five factors affect the test for Al with aluminon—time, temp.,

vol., concn. and presence of other ions. To det. Al in water, add 2 cc. of 4 *N* HCl, evap. to dryness and ignite. Cool, add 4 drops of 4 *N* HCl and 5 cc. of hot water. Filter, wash 3 times with hot water, make neutral with 4 *N* HCl, transfer to a Nessler tube and treat with 5 cc. of *N* HCl, 5 cc. of 3 *N* NH_4OAc , water to make 30 cc. and 5 cc. of 0.1% aluminon. After 5 min. slowly add, while stirring, 5 cc. of 5 *N* NH_4OH and 10 cc. of 5 *N* $(\text{NH}_4)_2\text{CO}_3$. Dil. to 50 cc., mix and after aging for 20 min. compare the resulting color with that similarly produced and aged with solns. contg. known amts. of Al.

W. T. H.

Further notes on the separation of vanadium from tungsten. S. G. CLARKE. *Analyst* 52, 527(1927).—Additional references are given and the following suggestions for detg. small quantities of V such as are likely to be retained by the WO_3 obtained in steel analysis. Before adding the cupferron, add 50 g. of NH_4Cl . Ignite the ppt., heat with fusion mixt. and det. the V colorimetrically with H_2O_2 according to Meyer and Pawletta (*C. A.* 21, 32).

W. T. H.

Measurement of hydrogen-ion concentration by means of colloid films containing indicators. PETER WULFF. *Kolloid-Z.* 40, 341-2(1926).—"Indicator foils" are made by incorporating the indicators in thin films of a colorless and transparent colloid that forms a jelly swelling to a limited extent in H_2O and that is chem. non-reactive. Cellulose jellies are the only suitable ones found so far. With such indicator foils the p_{H} of turbid and colored solns. can be detd. quickly by dipping the foil in the soln. for 1 or 2 min. and comparing the color with a color scale. The indicator does not leach easily and the suspended or colloiddally dispersed materials usually responsible for the turbidity and color of commercially important solns. is not absorbed by the foil and does not obscure the indicator's color.

F. L. BROWNE

A new method for determining p_{H} values. KURT WOLF. *Collegium* 1927, 370-97.—In colloidal solns., lime liquors or tannin exts., in which the H electrode fails, 3 other methods may be used. Glass electrodes or bright metal electrodes (cf. Cox, *C. I.* 19, 2610) are suitable for measurements or titration curves. An electron tube arrangement is most satisfactory for measuring the potential, but the tube must allow no flow through the grid circuit and the anode current must change only when the grid potential changes. Soft soda glass is best for the glass electrodes. A Pt wire covered with a thin coating of glass can be used instead of a glass bulb. The 2-metal system Pt-Au was useless, probably because the metals adsorb H to about the same extent.

I. D. C.

Determination of the sulfate ion by the palmitate method. JULIUS ZINK AND FRIEDR. HOLLANDT. *Z. anal. Chem.* 71, 386-7(1927).—Bahrdt (*C. A.* 21, 1506) has published a method very similar to that proposed by Z. and H. (*C. A.* 8, 2436, 3335). The method has given good results even under conditions where B. has doubted its accuracy.

W. T. H.

Volumetric estimation of sulfates. MARIO TALENTI. *Giorn. chim. ind. applicata* 8, 611 2(1926).—T. chooses the Wolf-Müller method, but with modifications, as follows: Suspend pure benzidine in H_2O in an amt. equal to about 2% of the H_2O , warm gently, stirring slightly, and acidify with concd. HCl to give an acidity of about 0.25 *N*. Filter the dark-colored soln., titrate exactly with a soln. of NaOH or KOH (0.5 *N* will do), using phenolphthalein as indicator and disregarding the benzidine set free. The SO_4 ions to be estd. may occur in 3 forms: (1) As free H_2SO_4 . Approx. of simple acidimetry is the best here. (2) As alkali sulfate. Dil. to about 0.5% and measure its acidity. Take an aliquot part and add it with stirring to a known amt. of cold titrated benzidine-HCl in excess. Allow the cryst. ppt. to stand for a few min., filter, wash with a little cold H_2O and retitrate the acidity in the filtrate. The diminution of acidity measures the amount of H_2SO_4 present and pptd. as benzidine sulfate. (3) As a heavy-metal sulfate. Ppt. the metal with its characteristic analytical reagent (e. g., $\text{Fe}_2(\text{SO}_4)_3$ with NH_4OH), filter, wash and proceed with the filtrate as under (2) above. Results are very satisfactory, and the time required, at the most, is not over 40 min.

ROBERT S. POSMONTIER

Determination of sulfide, thiosulfate and sulfur in the presence of carbonate insoluble in water, especially barium carbonate. H. BRINTZINGER AND F. RODIS. *Z. anal. Chem.* 71, 434-41(1927).— BaCO_3 is usually made from barite by reduction with C and the last traces of S compds. are very hard to remove. It is desirable, therefore, to have a method for the detn. of sulfide, thiosulfate and S in com. BaCO_3 . The samples analyzed contained 99.24-99.59% BaCO_3 , 0.07-0.17% BaS, 0.02-0.10% $\text{Ba}_2\text{S}_2\text{O}_3$ and 0.004-0.013% S. The procedure recommended is as follows: First, det. Ba by a method similar to that used for the detn. of S in steel, using 10 g. of sample, decomp. with 100 cc. of 2 *N* H_2SO_4 , absorbing the evolved H_2S in $\text{Cd}(\text{OAc})_2$ and titrating the

CdS ppt. iodometrically. The $\text{Cd}(\text{OAc})_2$ soln. will also contain some dissolved SO_2 , which must be removed by boiling in a vacuum for about 20 min. before titrating. Next det. $\text{BaS} + \text{Ba}_2\text{S}_2\text{O}_3$ by treating another 10 g. of sample with 50 cc. of 0.01 N KI , soln. and adding 2 N HCl until the BaCO_3 is all dissolved. Remove the CO_2 by gently boiling and pass the vapors through KI soln. to absorb any volatilized I_2 . Finally titrate the excess of KI with thiosulfate. The residue in the decompn. flask now contains a suspension of BaSO_4 together with the original S and any S that may have been formed from the $\text{Ba}_2\text{S}_2\text{O}_3$. Heat this in a large Erlenmeyer flask with 50 cc. of 0.01 N KMnO_4 and after about 20 min. titrate the excess permanganate with oxalic acid. Finally det. $\text{BaCO}_3 + \text{BaS} + \text{Ba}_2\text{S}_2\text{O}_3$ by treating with a measured vol. of 0.5 N HCl , heating to remove SO_2 and CO_2 and titrating the excess HCl with 0.5 N NaOH in the cold using methyl orange as indicator. W. T. H.

The detection of chlorides in mercuric oxide. G. J. W. FERREY. *Pharm. J.* 118, 767-9, 794; *Chemist & Druggist* 107, 36(1927).—The presence of halogen affects the Brit. Pharm. detn. of HgO by the NH_4CNS method. Several published tests for chlorides in HgO proved very insensitive and useless for the detection of less than about 0.7% calcd. as HCl . The delicacy of these tests increases with concn. of AgNO_3 , but is independent of the concn. of HNO_3 . By using AcOH as a solvent, the test may become delicate to about 0.4%. The most satisfactory method is to remove the Hg from H_2SO_4 soln. by metallic Zn ; this detects less than 0.02% of HCl ; removal of Hg as basic carbonate is somewhat less sensitive. Dissolve 1 g. HgO in 10 cc. of 25% H_2SO_4 and 10 cc. H_2O , adding 1-2 drops of HNO_3 ; add 1 g. Zn turnings, after 5 min. filter. The soln. should not give more than the faintest opalescence on the addn. of a little HNO_3 and 2 cc. of 0.1 N AgNO_3 for each 10 cc. of soln. S. WALDBOTT

Determination of soluble fluorides. F. L. HAHN. *Z. anal. Chem.* 69, 385-6 (1926).—To the concd. soln. add NaOH till alk. and neutralize with AcOH . Add Na_2SO_4 to provide at least 0.2 g. of this salt for the same quantity of F in 100 cc. Add an excess of CaCl_2 soln., weigh the resulting ppt. of CaF_2 and check by converting to CaSO_4 in the usual way. W. T. H.

Official method for the analysis of sodium sulfide. ATKIN AND HUGONIN. *Boll. industria pelli* 3, 298-9(1925); *Chem. Zentr.* 1926, II, 469-70.—Dissolve the sample (contg. about 2 g. of Na_2S) in 500 cc. of cold water, clarify 200 cc. with 3-4 g. of $\text{Ca}(\text{OH})_2$, filter rapidly, add to 25 cc. of the filtrate 25 cc. of 0.5 N NH_4OH (contg. 12.5 g. of NH_4Cl per l.), and titrate with 0.05 M ZnSO_4 detg. the end point by a spot test with $\text{Pb}(\text{OAc})_2$ paper. C. C. DAVIS

Determination of iodide in mixtures of halides. HARRY BAINES. *J. Soc. Chem. Ind.* 46, 381-2T(1927).—A method practically the same as that published by Chick (*C. A.* 21, 3174) was worked out independently. H_2SO_4 was used for acidulating and the AgNO_3 used was 0.01 N and standardized against KI by the same method as that used in the analysis. After the detn. of iodide, the soln. was neutralized with CaCO_3 and Mohr's method used for detg. Br^- (and Cl^-). The method was used for the examn. of photographic paper. W. T. H.

A volumetric method for the separation of selenium and tellurium. LUDWIG MOSER. *Chem.-Ztg.* 51, 729(1927).—Certain mistakes in the paper of Littmann (*C. A.* 21, 2238) are pointed out. W. T. H.

A simple method for the determination of available chlorine in bleaching liquors. WALTHER HERZOG. *Chem.-Ztg.* 51, 729(1927). JUSTIN HAUSNER. *Idem.*—A polemical discussion (cf. *C. A.* 21, 2236). Also in *Papir-J.* 15, 155(1927). W. T. H.

A note on I. Bang's micro-method for nitrogen determination. KENZO SURO. *Biochem. Z.* 187, 78 83(1927).—The use of a Ag condenser in the distn. of NH_3 is undesirable because it always gives rise to alkali because of the formation of Ag_2S with the H_2S from the rubber connections. A good glass condenser (Jena or hard glass) can be safely used instead of one made from quartz or Pt. S. MORGULIS

Accurate colorimetric determination of small quantities of phosphorus dissolved in oil. C. STICH. *Z. angew. Chem.* 40, 1014(1927).—As reagent a satd. soln. of AgNO_3 in acetone is used and as solvent a mixt. of 40 cc. of ether, 20 cc. of alc. and 5 cc. of acetone. Dil. the oil with 10 times its vol. of the solvent and add the reagent. Gradually a brown coloration is produced which can be used for the colorimetric detn. if the P content is not too high. To prep. the standards dissolve about 0.05 g. of colorless P in benzaldehyde to make a 0.1% soln., adding 2% of ether and 1% of terpene as anti-catalyzers. Mix 10 g. of the soln. obtained in this way with 90 g. of a fatty oil. One g. of this last soln. will then contain about 1 mg. of P . Prep. standards with 0.1, 0.2, 0.4, 0.6, 0.8 and 1.0 g. of P . W. T. H.

A forgotten, very useful process for the determination of boric acid in silicates.

RUDOLF SCHMIDT. *Sprechsaal* 59, 541-3(1926); *Chem. Zentr.* 1926, II, 2010.—A discussion of well-known methods and their defects. According to Fromme (cf. *C. A.* 4, 1586) B_2O_3 does not affect the indicator if, after complete removal of SiO_2 , HCl is added in the presence of methyl orange to an alk. borate soln. until red. Therefore after addn. of glycerol, B_2O_3 can be detd. in the well-known way with CO_2 -free NaOH, phenolphthalein being used. C. C. DAVIS

General method for the estimation of carbon dioxide and of carbonates in solution. Application to the determination of carbon dioxide in body fluids, mineral waters, etc. MAURICE NICLOUX. *Bull. soc. chim. biol.* 9, 758-71(1927); cf. *C. A.* 8, 3666; 21, 1945.—N.'s work on this problem is summarized. The liquid to be tested, which may contain from 0.2 to 200 cc. of CO_2 per 100 cc., is distd. with a mixt. of HCl and octylic alc. and the evolved CO_2 is absorbed by KOH soln. Detailed directions are given for the detn. of CO_2 in various body fluids. L. W. RIGGS

The determination of moisture by the volatile solvent method. J. M. JONES AND T. MCILACHLAN. *Analyst* 52, 383-7(1927).—The method consists in placing the sample together with a little sand in a flask with some light liquid which is immiscible with water, boiling and condensing the distillate so that it falls into a graduated tube. The water falls to the bottom of the tube and its vol. is detd. The most satisfactory liquid to use appears to be toluene. Boiling should be continued until it is certain that all water has been removed. The method is satisfactory for emulsions, including butter, and is more rapid than oven drying. The results with jam, honey and malt ext. are more consistent but it is not certain that they are more accurate. For powders and substances which do not cake together, oven-drying is better and quicker. W. T. H.

Determination of water by distillation. F. GISIGER. *Mitt. Lebensm. Hyg.* 18, 249-53(1927).—Water is detd. by distn. from the sample by means of such distg. agents as benzene, toluene, xylene and acetylene tetrachloride. The media of distn. together with the H_2O in the sample is distd. into a measuring tube, the water layer measured and the detn. calcd. RUSSELL C. ERB

The identification of seminal stains. S. MALLANAH. *Analyst* 52, 399(1927).—The contention is made that the chief cause for failure to detect spermatozoa is that the proper stain is not used. Positive results have been obtained almost invariably by the following method. Cut off a piece of suspected cloth and place it in a sterile Petri dish contg. sufficient soln. to soak the cloth. After a few min., gently scrape off the cloth, spread out the scrapings on a microscopic slide, allow to dry in the air and fix with the flame of a spirit lamp. Cover with a few drops of carbol thionine and after a few min. wash off with water and place in an inclined position so that the slide will dry. When dry, exam. with a $1/12$ oil-immersion lens after adding a little oil of cedar. W. T. H.

Analysis of lithopone. T. S. REMINGTON. *Ind. Chemist* 3, 353-4(1927).—Several schemes for the analysis of lithopone are described and criticized. A somewhat different scheme of proximate analysis is given in detail and the results of the analysis of 12 English samples of this pigment are shown. W. T. H.

The determination of water in organic substances with the aid of calcium carbide. A. CANTZLER AND S. ROTHSCILD. *Z. Untersuch. Lebensmittel.* 53, 125-35(1927).—Good results were obtained in the detn. of H_2O in org. substances by means of CaC_2 , in a suitable app., even in the presence of other volatile constituents. The results agree with those obtained in a vacuum app. WILLIAM J. HUSA

Determination of water in mixtures of benzene and alcohol. D. PETERS. *Z. angew. Chem.* 40, 1011-13(1927).—First det. the benzene content by shaking with added water and measuring the benzene layer. Then det. the temp. at which the formation of layers takes place and compare the result with a curve corresponding to the same benzene content and showing the sepn. temps. of known mixts. W. T. H.

Estimation of carbon by wet combustion. H. O. ASKEW. *Trans. Proc. New Zealand Inst.* 58, 174-8(1927).—The details of a chromic acid method are given with special reference to the detn. of EtOH in dil. solns. L. W. RIGGS

The colorimetric determination of carbon monoxide with ammoniacal silver solution. H. KAST AND A. SCHMIDT. *Gas u. Wasserfach* 70, 821-2(1927); cf. *C. A.* 21, 2630; *Glückauf* 62, 804(1926).—This test is satisfactory for the detn. of small quantities of (0.1 to 1.0%) CO in technical gases or air when the amt. of C_2H_2 is substantially less than the CO and when no very large amts. (10% or more) of ethylene are present. H_2 and CH_4 do not interfere with the test. R. W. RYAN

General applicability of wet oxidation for the carbon determination in organic substances. II. Determination of chlorine, bromine, iodine and nitrogen besides

carbon in organic matter by the wet combustion method. B. LUSTIG. *Biochem. Z.* **185**, 349-54(1927); cf. *C. A.* **21**, 2634.—Reliable results are obtained in N and halogen detns. made on org. substance oxidized by the wet process with dil. H_2SO_4 and KMnO_4 with or without Pt as catalyst. Azo- and diazo-N combinations are not determinable by this method.

A new and very practical method for distinguishing between phthalic and terephthalic acids. R. RIPAN. *Bul. soc. stiinte (Iuj)* **3**, 308-10(1926).—The pyridine deriv. of Cu terephthalate, $[\text{CuPy}_3(\text{H}_2\text{O})_3](\text{O}_2\text{C})_2\text{C}_6\text{H}_4$, is very difficultly sol., while the pyridine deriv. of Cu phthalate, $[\text{CuPy}_2](\text{O}_2\text{CC}_6\text{H}_4\text{CO}_2\text{H})_2$, ppts. only from very concd. solns. The reagent consists of a 4% CuSO_4 soln. to which pyridine is added (4-5 drops to each 10 cc.) at the time of using. To 10 cc. of reagent, several cc. of unknown at about 2% concn. are added. If as much as 0.002 g. terephthalic acid is present, a blue ppt. forms immediately, whereas with phthalic acid there will be no pptn. for several hrs., if at all. The reaction can also be used to detect small quantities of terephthalic acid in the presence of larger amts. of phthalic acid.

RUBY K. WORNER

Analysis of phenol. SALVADOR DELMUNDO. *Philippine J. Sci.* **33**, 363-73(1927).—A short history of the development of the Koppeschaar method for detg. phenol is given. In working with aq. solns. of nearly pure phenol the volumetric method of K. is fairly accurate. The process, however, should be modified by using sirupy H_3PO_4 instead of concd. HCl to liberate Br from the $\text{KBr} + \text{KBrO}_3$ mixt. The gravimetric method is as rapid as the volumetric but the difficulty lies in pptg. either tribromophenol or tribromophenol bromide to the exclusion of the other. Errors on page 405 of Sutton's *Handbook of Vol. Anal.*, 11th edition (1924) are noted. I. W. R.

Some tests for the identification of sulfonal. CLEMENT GENOT. *J. pharm. Belg.* **8**, 435-9(1926).—The soly. of sulfonal in a large no. of solvents is given. Numerous microchem. and cryst. reactions are described. The article is illustrated with photomicrographs of the cryst. forms obtained from 5 different solvents. A. G. D.

The determination of the amino group in nitroarylamines. I. Determination of nitroaniline and nitroacetaldehyde. N. SEMIGANOWSKI. *Z. anal. Chem.* **72**, 27-30(1927).—The method depends upon the decompn. of the sample by boiling with aq. alkali hydroxide, distg. off the NH_3 formed, collecting the distillate in a known vol. of standard acid and titrating the excess acid. It works well with *o*- and *p*-acetanilide and with *o*- and *p*-nitroaniline but in the case of the meta-substitution products the yield of NH_3 is too low.

W. T. H.

Method for determining phenylacetylene. FR. HEIN AND A. MEYER. *Z. anal. Chem.* **72**, 30-1(1927).—The pptn. of cuprous phenylacetylde can be used for gravimetrically detg. phenylacetylene and the ppt. can also be titrated oxidimetrically. Dissolve the sample in 10 times as much alc. and add an ammoniacal soln. of CuCl prepd. as recommended either by Ilosvay Nagy Ilosva or by F. Straus. Shake well, filtr, wash with alc. and ether, dry in a vacuum over concd. H_2SO_4 and weigh. Or, dissolve the ppt. in an acid soln. of ferric salt and titrate the resulting ferrous soln. with KMnO_4 . One mol. of $\text{C}_8\text{H}_5\text{Cu}$ gives 1 mol. of ferrous salt.

W. T. H.

A direct method for the detection and determination of methyl chloride. K. ROKA AND O. FUCHS. *Z. anal. Chem.* **71**, 381-6(1927).— CH_3Cl heated in alc. soln with NaI is decomposed forming CHI_3 and NaCl . The CHI_3 can be distd. off and the distillate caught in alc. AgNO_3 soln. forming at first $\text{CH}_3\text{I} \cdot \text{AgNO}_3$ and then by decompn. with water AgI which can be weighed. Careful testing of the method shows that the reactions are not absolutely quant. and 94% yield of AgI is the best that can be obtained but if a corresponding correction is made, fairly satisfactory results can be obtained. Take 10-15 cc. of the soln. in abs. alc. contg. 1-2 millimols. of CH_3Cl and add about 1 g. of KI for each 4 cc. of liquid. Heat in a short, sealed tube for 3-4 hrs. at 60° , shaking every 10 min. Then distil off the CH_3I as in the Zeisel method for detg. methoxyl, weigh the AgI and multiply the wt. of CH_3Cl equiv. to the AgI by 1.064.

W. T. H.

The copper number for glucose. CHESTER A. AMICK. *J. Phys. Chem.* **31**, 1441-77(1927).—Glucose was chosen for a study of the Cu no. because it has a known mol wt. which can aid in establishing the course of the oxidation and any conclusion based on a study of glucose is applicable to some extent to cellulose. That the use of alk. Cu solns. in estg. glucose is valueless has been confirmed. The amt. of O used is dependent on alky. of the soln. Formation of gluconic or saccharic acid is not a necessary step in oxidation. Carbonate-treated solns. give higher Cu nos. than those in which free alkali is used. The reducing action of sugars is not due to carboxyl formation from the carbonyl group. Oxidation of the carbonyl group to carboxyl stabilizes to mol. Filter paper, etc., adsorb alkali tartrate, which cannot be removed by washing.

The Bertrand volumetric method is inaccurate since Fe salts catalyze oxidation of adsorbed tartrates by permanganate. Pptd. Cu_2O can be estd. without filtering from the reaction mixts. in several ways. R. H. LAMBERT

Improved methods for determining impurities in crude camphor. I. Determination of water and solid matter. S. YAMADA AND T. KOSHITAKA. *J. Soc. Chem. Ind. (Japan)* 30, 356-9 (1927).—For the detn. of H_2O in crude camphor by distn. with volatile solvents, an improved app. was devised, which is a modified form of Normann's app. (*C. A.* 19, 2277). It is claimed that adhesion of condensed H_2O on the wall of the still-head is completely avoided by the use of a still-head provided with a specially designed built-in reflux condenser having an inverted part at its end, and thus an accurate result is secured. The use of toluene or xylene instead of benzene is recommended. The improved method gave more accurate results than the usual method of centrifugal sepn. Y. TOMODA

A study of the determination of saccharin colorimetrically and by the ammonia process. A. F. LERRIGO AND A. L. WILLIAMS. *Analyst* 52, 377-83 (1927).—The various colorimetric methods of detg. saccharin were tested and found less suitable than the well-known method of forming the NH_4 salt of sulfobenzoic acid, by boiling with dil. acids, and detg. the NH_3 by distn. into acid. W. T. H.

Determination of organic matter by chromic acid oxidation. TH. VON FELLEBERG. *Mitt. Lebensm. Hyg.* 18, 290-6.—The combustion method for org. matter, with a dichromate and H_2SO_4 was tried on a list of compds. This method is the basis of Bang's micro-fat detn. (Mikromethoden zur Blutuntersuchung 4 & 5, 1922.) It is suggested to use this method for food and biochemical analysis. RUSSELL C. ERB

The chemical constitution of the micas (JAKOB) 8. Nessler's reagent (NAUDE) 6.

PLATTNER, CARL FRIEDRICH: Determinations with the Blowpipe. (8th edition, by F. KOLBECK.) Leipzig: J. A. Barth. 500 pp. Reviewed in *Mineralog. Abstracts* 3, 320 (1927).

Rapid analysis of alloys. D. W. BERLIN. Swed. 63,238, June 28, 1927. The elec. cond. and sp. gr. of a test specimen are compared with the same properties measured on standard specimens of known compn.

8—MINERALOGICAL AND GEOLOGICAL CHEMISTRY

EDGAR T. WHERRY AND J. F. SCHAIRER

Nomenclature in mineralogy. N. FEDOROVSKII. *Centr. Mineral. Geol.* 1927A, 76-80.—F. advocates revision of the present mineral names by an international congress. A more systematic and simpler terminology is needed. Guiding principles are suggested. J. E. GILL

Note on a new palladium mineral from Potgietersrust platinum fields. H. R. ADAM. *J. Chem. Met. Mining Soc. S. Africa* 27, 249-50 (1927).—At the farm Tweefontein a new Pd mineral occurs with Pd-free sperrylite (PtAs_2). An analysis on slightly impure material gave: Pd 70.4, Sb 26.0, insol. 1.4, Fe (as Fe_3O_4) 0.9%; this approaches Pd_3Sb ; Pt is absent. It is silvery white, insol. in HCl , only slowly attacked by H_2SO_4 and HNO_3 , easily sol. in dil. $\text{HNO}_3 + \text{HCl}$, and has sp. gr. about 9.5. J. F. SCHAIRER

The crystal structure of berzelianite (Cu_2Se). W. HARTWIG. *Z. Krist.* 64, 503-4 (1927).— Cu_2Se has the fluorite structure with the edge of the unit cube 5.748 ± 0.005 A. U. for synthetic material, and 5.731 for a specimen of the natural mineral. Davey's results (*C. A.* 18, 2092) are confirmed. I. S. RAMSDELL

Ore deposits of the Harz. II. A few selenium ores and their paragenesis. GEORG FREIBOLD. *Centr. Mineral. Geol.* 1927A, 16-32.—Brief descriptions of the selenides and their occurrences are followed by more complete descriptions of their phys. and chem. characteristics. Clausthalite (PbSe), tiemannite (HgSe), naumannite (Ag_2Se) and umangite (Cu_2Se_2) are recognized as definite minerals. Lehrsbachite, zorgite, seebachite and Pb-Co selenide are mixts. of the above. The distribution is discussed. The paragenesis at Lautenthal is hematite and cobaltite, dolomite, clausthalite (youngest) at Clausthal, pyrite, quartz, calcite, chalcopyrite, clausthalite, tiemannite; at Lehrsbach, dolomite, clausthalite, tiemannite, umangite, chalcocite (isometric) also, below 91° , chalcocite, bornite, chalcopyrite; at Zorge, quartz, hematite, calcite, clausthalite, tiemannite, umangite; at Tilkeroode, pyrite, quartz, dolomite, calcite, chalcopyrite, selenides (clausthalite, naumannite, tiemannite). J. E. GILL

The synthesis of ullmannite. N. S. KURNAKOV AND YA. POSTERNAK. *Ann. inst. anal. phys. chim.* 3, 484-5(1926).—BaCl₂ (90%) and 10% NaCl are melted in a graphite crucible, Ni₃Sb is added, the temp. raised to 1200° and Sb₂S₃ introduced in small pieces. Upon very slow cooling cubes and dodecahedrons of NiSSb sep.; the $d_{20} = 6.62$; it m. 758° without decomp.

BASIL C. SOYENKOFF

The crystal structure of linnaeite, polydymite and synchodymite. G. MENZER. *Z. Krist.* 64, 506-7(1927).—These 3 minerals all have nearly identical structures. They are face-centered cubic, with 8 mols. in the unit cell, and with an at. arrangement analogous to that of magnetite. The cube edges are 9.398, 9.405, and 9.434 ± 0.007 A. U., resp. There is no evidence for regarding polydymite and synchodymite as minerals distinct from linnaeite (Co, Ni)₈S₄ with a differing ratio of (Co, Ni) to S. L. S. R.

The mineral villiaumite. TOM. BARTH AND GULBRAND LUNDE. *Centr. Mineral. Geol.* 1927A, 57-66.—Villiaumite, described as tetragonal, gives x-ray interferences that are identical with those of NaF. The lattice const. is almost exactly that of c. p. NaF (NaCl type). Coloring and double refraction must be due to penetration of rays, probably radioactive, combined with the mech. requirements of the crystal. NaF subjected to x-rays acquired the properties of villiaumite.

J. E. G.

Magnetite crystals in sinters. G. M. SCHWARTZ. *Eng. Mining J.* 124, 453-5 (1927).—Examn. of polished surfaces of iron-ore sinters has permitted the accumulation of data regarding the sequence of crystn. The significance of and the following generalizations with regard to euhedral crystals in ores are made: (1) euhedral crystals imbedded in other minerals in an ore may be earlier than, contemporaneous with, or later than, surrounding minerals; (2) earlier crystals will as a rule show corrosion or replacement; lacking this, there may be no doubt as to relative age; (3) evidences of contemporaneity are not abundant; and (4) euhedral minerals where a persisting mineral is obviously replaced. Six photomicrographs show the stages of cryst. growth.

W. H. BOYNTON

The crystal structure of hausmannite (MnMn₂O₄). G. AMINOFF. *Z. Krist.* 64, 475-90(1927).—The structure can be interpreted either as body-centered tetragonal, with $a = 5.75$ and $c = 9.42$, or as face-centered, with $a = 8.14$ and $c = 9.42$. There are 8 mols. in the unit cell, which has the symmetry of space group D_{4h}^{19} . An arrangement of the atoms which agrees with the data and at the same time best agrees with the at. radii makes the structure analogous to that of magnetite, except that the axial ratio is 1 : 1.16 instead of 1 : 1.

L. S. RAMSDELL

Ilmenite from the Chibine Mountains. A. N. LABUNTZOV. *Trav. Musée Min. Acad. Sci. U. S. S. R.* 1, 35-42(1926); *Mineralog. Abstracts* 3, 308.—Four analyses of ilmenite are given.

J. F. SCHAIER

Analyses of Hungarian dolomite crystals. ILONA STROBENTZ. *Földtani Közlöny* 55, 49-57(Hung.), 275(German) (1925); *Mineralog. Abstracts* 3, 301.—Fifteen analyses of dolomite and ankerite are given.

J. F. SCHAIER

The optical properties of the andesine of Bodenmais. E. ERNST. *Sitzb. Heidelberg. Akad. Wiss.* 1926, No. 5, 3-21; *Chem. Zentr.* 1926, II, 2047.—Bodenmais andesine contains 28.80% anorthite and 4.56 K-feldspar and has $d. 2.666 \pm 0.003$, $2V = 87.2^\circ \pm 0.6^\circ$, $\alpha_D 1.5445 \pm 0.0002$, $\beta 1.5486 \pm 0.0001$ and $\gamma 1.5520 \pm 0.002$. C. C. D.

Mineralogical notes. R. T. HODGE SMITH. *Rec. Australian Mus.* 15, 69-78 (1926); *Mineralog. Abstracts* 3, 295.—The so-called green rhodonite from Broken Hill is identical with manganhedenbergite. *Analyses of albite and autunite* are given.

J. F. SCHAIER

Lievrite (ilvaite) from the arsenic deposit of Djimara, North Caucasus. I. G. KUZNETZOV. *Bull. Com. Geol. Russie* 44, 721-3(1925); *Mineralog. Abstracts* 3, 307.—Two analyses of ilvaite are given.

J. F. SCHAIER

Zoned nephelite. F. BECKE AND J. E. HIBSCH. *Anz. Akad. Wiss. Wien* 62, 243-4(1925).—According to Bowen's data (C. A. 6, 2221) if mix-crystals of Na₂Al₂Si₂O₈ and CaAl₂Si₂O₈ did not change in compn. and remain in equil. with the liquid melt, zoned nephelite crystals would be possible. Such zoned nephelite crystals in nephelite-phonolite from the Bohemian Mittlegebirges are described briefly.

J. F. S.

The structure of nephelite. C. GOTTFRIED. *Z. Krist.* 65, 100-9(1927).—An x-ray detn. on a natural crystal gave a unit cell with $a = 10.09$ and $c = 8.49$ A. U., contg. 16 mols. and belonging to the space group C_6^2 .

L. S. RAMSDELL

The space group of helvite. C. GOTTFRIED. *Z. Krist.* 65, 425-7(1927).—Helvite, (SiO₄)₂Be₂(Mn, Fe)₂MnS₂, is cubic with the symmetry of T_d^2 . There are 2 mols. in the unit cell, the edge of which is 8.52 A. U.

L. S. RAMSDELL

An unnamed mineral of the olivine group. C. E. TILLEY. *Geol. Mag.* 64, 143-4

(1927).—A Ca orthosilicate described by Paul (cf. C. A. 1, 30) from Shannon Tier, Tasmania is identical with the β - Ca_2SiO_4 described by Day, Shepherd and Wright (C. A. 1, 28). The name *shannonite* is suggested as a mineralogical name for this compd.

J. F. SCHAIRES

X-ray study of silicates. B. GOSSNER. *Centr. Mineral. Geol.* 1927A, 39–44.—The unit cell of *phenacite* is a rhombohedron {100} with $\alpha = 108^\circ 1'$, $a = 7.68 \times 10^{-8}$ cm. and 6 mols. Be_2SiO_4 . The unit cell of *diopside* is a rhombohedron {100} with $\alpha = 111^\circ 42'$, $a = 8.77 \times 10^{-8}$ cm. and 6 mols. $\text{SiO}_2 \cdot \text{CaO} \cdot \text{H}_2$. The at. arrangements are discussed.

J. E. GILL

Some mineral associations from the Norberg district. PER GEIJER. *Sveriges Geol. Undersökning Årsbok* No. 4, 32 pp. (1926); *Mineralog. Abstracts* 3, 273.—The Fe ores of Norberg consist of magnetite in silicate skarn. Analyses of *allanite* (orthite), *Mg-orthite*, *norbergite* and *fluorborite* are given. The compn. of orthite and Mg-orthite is discussed in detail. Minerals contg. the $\text{Mg}(\text{F}, \text{OH})_2$ group occur at Norberg and have been formed by the high-temp. metasomatism of dolomite caused by emanations from a granite.

J. F. SCHAIRES

The chemical composition of the wöhlerite from the Chibine Mountains. G. CHERNIK. *Compt. rend. acad. sci. Russ.* 1923, 37–9; *Chem. Zentr.* 1926, I, 3456.—The wöhlerite forms small, tabular, lemon-yellow crystals, often interspersed with sphene. It is brittle, has hardness 6, d. 3.48, and is optically negative. Its compn. corresponds to the formula: $\{12\text{R}(\text{Si}, \text{Ti}, \text{Zr})\text{O}_3 \cdot \text{R}(\text{Nb}, \text{Ta})_2\text{O}_6\} \cdot 0.05\{[(\text{Ce}), \text{Fe}] \text{Fe}_6\} \cdot 0.5\text{H}_2\text{O}$, where R is Ca, Fe^{++} , Na_2 or K_2Mg .

C. C. DAVIS

The dehydration of apophyllite. A. CAVINATO. *Atti accad. Lincei* [6], 5, 907–10 (1927).—Two samples of very pure apophyllite (from Andreasberg and from New Jersey) on dehydration at different temps. reached a max. loss of 17.20% water at 700°. Evolution of water was extremely slow, e. g., heating for 366 hrs. was required to reach equl. with a partial loss of 13.28%. This 17.20% max. loss and the losses at all the lower temps. are much higher than ever reported before (cf. Z. deut. Geol. Ges. 20, 443 (1868); Hersch, *Dissertation Zürich* 1887; Z. Kryst. 34, 691 (1901); *Proc. verb. soc. Toscana sci. nat.* 15 (1906); Columba, *Rend. accad. Lincei* I, 1907; Zambonini, *Contributo allo studio dei silicati idrati*, Napoli, 1908; di Franco, *Atti accad. sci. nat. Catania* 15, (1926); Henning, *Handbuch der Mineralchemie*, II, iii, 477); this is due to the fact that none of the previous investigators heated their samples long enough. At 280° the apophyllite lost its transparency and the latter was not restored by immersion in oil.

C. C. DAVIS

Notes on the occurrence of zeolites, Ardglen, New South Wales. T. HODGE SMITH. *Rec. Australian Mus.* 14, 213–22 (1924); *Mineralog. Abstracts* 3, 287.—An analysis of fresh columnar basalt is included.

J. F. SCHAIRES

Truscottite. J. A. GRUTLERINK. *Verh. Geol.-Mijnb. Genootschap Nederland, Geol. Series* 8, 197–200 (1925); *Mineralog. Abstracts* 3, 271.—Truscottite, from the Je-hong Donok Au-mine, Benkoelen, Sumatra, forms white spheroidal aggregates with fibrous, platy structure and pearly luster on the cleavage. Fibers show straight extinction and—elongation with $n = 1.560$; sp. gr. 2.47. The formula assigned (H_2O lost below 120° being omitted) is $2(\text{Ca}, \text{Mg})\text{O} \cdot 3\text{SiO}_2 \cdot 1.3\text{H}_2\text{O}$, or if all the H_2O is considered as constitutional the formula is that of gyrolite. Truscottite is considered to be a zeolite of the gyrolite group.

J. F. SCHAIRES

Laumontite from Graf Cziraky, Nadap. R. REICHERT. *Földtani Közlöny* 54, 77–9 (Hungarian), 187–9 (German) (1925); *Mineralog. Abstracts* 3, 287.—An analysis of somewhat altered laumontite is given.

J. F. SCHAIRES

Natrolite from the Chibine Mountains and Lujawrurt in Russian Lapland. A. N. LABUNTZOV. *Trav. Musée Géol. Min. Pierre le Grand, Acad. Sci. Russ.* 5, 17–32 (1925).—An analysis of pink natrolite from Yukspor is given.

J. F. SCHAIRES

The chemical constitution of the micas. III. J. JAKOB. *Z. Krist.* 64, 430–54 (1927).—A complete description of the methods of chem. analysis used in this study of the mica group. (Cf. C. A. 19, 2007; 20, 2301.)

L. S. RAMSDALL

Biotite in tertiary eruptive rocks of Bohemia. GERDA SCHAUBERGER. *Centr. Mineral. Geol.* 1927A, 89–106.—Descriptions of various occurrences, optical data and chem. analyses are given. It is found that Fe-rich biotite occurs in the acid and Mg-rich in the basic members of a rock series. The compn. of the biotite depends on the relative proportions of the Fe and Mg, not on the abs. quantities of these elements in the host rocks.

J. E. GILL

A radioactive mineral from the Santa Clara estate, Pomba, Minas Geraes. D. JALMA GUIMARAES. *Bol. inst. brasileiro sci.* 2, 114–23 (1926).—Six analyses of polycrasegare included with crystallographic and optical data.

J. F. SCHAIRES

Loparite, a new mineral of the rare elements. I. G. KUZNETZOV. *Bull. Com. Geol. Russie* 44, 663-82(1925); *Mineralog. Abstracts* 3, 275.—Loparite from the nephelite-syenite near Imandra is described as isometric, $n = 2.3 - 2.4$, infusible before the blow-pipe, insol. in acids except H_2F_2 . Formula: $11 Ce(TiO_3)_2 \cdot 6(Di, La, Y)_2(TiO_3)_2 \cdot 6CaTiO_3 \cdot 9(Na, K)TiO_3$. Loparite is a member of the perovskite group, with knopite lying between it and perovskite. J. F. SCHAIRER

Mineral veins of Werfen, Salzkammergut. F. HEGEMANN AND H. STEINMETZ. *Centr. Mineral. Geol.* 1927A, 45-56.—Veins cutting slates contain quartz, breunnerite, hematite, lazulite, wagnerite, chlorite, rarely chalcopyrite and through alteration, aragonite. Three distinct groups are recognized and each is described in detail. Measurements of breunnerite, wagnerite and barite crystals and an analysis of wagnerite are given. J. E. GILL

Phosphophyllite and reddingite from Hagendorf. H. STEINMETZ. *Z. Krist.* 64, 405-12(1927).—An analysis of new material gives the following revised formula for phosphophyllite: $P_2O_5 \cdot 3RO \cdot 4H_2O$, where $RO = FeO + MnO$, and ZnO . The ratio of $FeO + MnO$ to ZnO is 1:1.75. Thus phosphophyllite is isomorphous with hopeite ($P_2O_5 \cdot 3ZnO \cdot 4H_2O$) with similar crystal angles, although hopeite is orthorhombic while the former is monoclinic. Phosphoferrite, previously described as a new mineral from this locality, is found to be reddingite ($P_2O_5 \cdot 3MnO \cdot 3H_2O$) with a high Fe content. L. S. RAMSDELL

Chemical and spectrographic study of pyromorphite from Braubach, Nassau. B. CAROBBI AND S. RESTAINO. *Rend. accad. sci. Napoli* 32, 17-27(1926).—This pyromorphite was studied with reference to the identification of the rare elements present in it. By chem. analysis, it contained 0.019% $La_2O_3 + Nd_2O_3 + Sm_2O_3$, 0.002 Ce_2O_3 , and 0.024 Y_2O_3 , etc. The presence of the following elements was established spectrographically: La, Nd, Sm, Y, Eu, Gd, Dy, Er, Yb and Ce. For each of the rare earth groups the elements present in the mineral are of even at. no., and those of odd at. no. are absent. This confirms a similar conclusion of V. M. Goldschmidt and L. Thomassen regarding the occurrence of the rare earth elements in apatite from several sources. The presence of Eu (at. no. 63) is an exception, possibly because of its forming $EuCl_2$ and thereby tending more strongly to form isomorphous mixts. with Pb compds. An earlier analysis is quoted. R. H. LOMBARD

Chemical and spectrographic study of pyromorphite from Leadhills, Scotland, and of mimetite from Santa Eulalia, Mexico. G. CAROBBI. *Rend. accad. sci. Napoli* 32, 54-69(1926).—This is a thorough chem. and spectrographic detn. of the elements which occur in these minerals in small quantities or as traces. In a 28-g. sample of the pyromorphite there was found by chem. methods, 0.1% Cr_2O_3 , 0.001 MnO , 0.16 CaO , a trace of SrO and BaO , and 0.02 rare earth oxides. Spectrographic examn. showed the presence of: Ce, La, Nd, Y, Eu, Gd, Dy, Er, and, in all probability, Yb and Ho. It is suggested that the Cr_2O_3 is present in pyromorphite as $PbCrO_4$, substituted isomorphously for a small quantity of $PbCl_2$. In about 16 g. of mimetite there were found by chem. detn., 0.07% Cr_2O_3 , 0.008 MnO , 1.37 ZnO , 0.29 CaO , and 0.009 $BaO + SrO$. Spectrographic study established the absence of elements of the rare earth group. R. H. LOMBARD

Scharizerite, a new mineral from the Drachenhöhle at Mixnitz, Steiermark. JOSEF SCHADLER. *Anz. Akad. Wiss. Wien.* 62, 180(1925).—A black asphalt-like substance which occurs with the phosphate ore at Mixnitz is described as a new mineral and called *scharizerite*. An analysis gave ash 17, C 35, H 4.5 and N (mean) 8%; P only in traces. The substance is completely sol. in NaOH soln. and is reprecip. by HCl. This so-called new mineral is said to be related to dopplertite and phytokollite. J. F. SCHAIRER

Ore at deep levels in the Cripple Creek district, Colorado. G. F. LOUGHLIN. *Am. Inst. Mining Met. Eng., Tech. Publ.*, No. 13, 32 pp.(1927).—A general discussion of the geology and ore prospects in this Au-district. An analysis of basaltic breccia is included. J. F. SCHAIRER

Scientific expedition to Karabugaz in the years 1921-23. N. I. PODKOPAEV. *Trans. Russ. Institute for Applied Chem.* No. 4, 3-10(1925).—A meteorological study in relation to the pptn. of glauber salt on the shore of the Karabugaz straits on the Caspian Sea. J. S. JOFFE

Observations on the geology of the Santa Elena Peninsula, Ecuador, South America. G. SHEPPARD. *J. Inst. Pet. Tech.* 13, 424-61(1927). GEORGE CALINGAERT

Bentonite. H. S. SPENCE. *Sprechsaal* 59, 183-6; *Chem. Zentr.* 1926, II, 96.—A review of the chem. compn., phys. properties and the applicability of the clay formerly termed "taylorite." (Cf. C. A. 19, 628.) C. C. DAVIS

Dissemination almost universal—accumulation rare. R. A. JONES. *Oil Weekly* 46, No. 12, 32-6(1927).—A general discussion of the migration and concn. of oil deposits.

M. B. HART

The Grozny petroleum field. V. STCHEPINSKY. *Ann. office nat. comb. liquides* 2, 47-67(1927). **The Bakou petroleum field.** *Ibid* 329-53(1927).—Descriptions of the geological formation and of the characteristics of the oil produced are given. A. P.-C.

Jet and jetonized material. E. H. C. CRAIG. *J. Inst. Petr. Tech.* 13, 343-62 (1927).—Microscopic. examn. shows that jet and "jetonized material" are of vegetal origin. Retorting of jet yields light oils, up to 58 gal per ton of jet. There is evidence of the formation of hydrocarbons in carbonaceous deposits in the jetonized stage. The theory of formation of petroleum through bacterial action is not supported by evidence. Jet represents an intermediate stage between wood and coal and also between wood and petroleum.

GEORGE CALINGAERT

Igneous geology of Ardsheal Hill, Argyllshire. FRÉDÉRIC WALKER. *Trans. Roy. Soc. Edinburgh* 55, 147-57(1927).—Geological. Analyses of orthoclase-olivine-basalt, kentalenite, appinite, hornblende-porphyrite, hypersthene-andesite, and hornblende-biotite-granodiorite are included.

J. F. SCHAIRER

Quantitative mineralogical composition of quartz-diorites from Kühlen Grund and Weinheim, Odenwald. PETER CHIRVINSKII. *Centr. Mineral. Geol.* 1926A, 395 9.—Micrometric measurement of the Kühlen Grund diorite gave by calcn.: plagioclase 31.82, quartz 0.84, hornblende 51.74, biotite 9.48, magnetite 5.20, apatite 0.76, pyrite 0.16%. The Weinheim diorite gave: feldspar 67.50, quartz 6.44, hornblende 10.22, biotite 15.56, magnetite 0.02, apatite 0.16, titanite 0.10%. The sp. gr. = 2.791.

J. E. GILL

Accessory rocks from the nephelite-syenite of Ditro. MIKLOS VENDL. *Math. Természettud. Értesítő* 43, 215-42(Hung.), 243 (German), (1926); *Mineralog. Abstracts* 3, 290.—Analyses of nephelite-syenite-aplite and amphibole-camptone are included.

J. F. SCHAIRER

Alkali-rocks in the neighborhood of Anina and Stajerlak. ALADAR VENDL. *Math. Természettud. Értesítő* 43, 244-53(Hung.), 254 (German), (1926); *Mineralog. Abstracts* 3, 290.—Analyses of limburgite and basanitic plagioclase-basalt are included. J. F. S.

Limestone inclusions in the basalt lava of Mayen. ADELE BRAUNS AND R. BRAUNS. *Centr. Mineral. Geol.* 1926A, 237-9.—The inclusions contain calcite, Ca hydroxide, free quartz, wollastonite, green diopside augite, Ca-Na feldspar, garnet, and ettringite. Chem. analysis gave: SiO₂ 18.38, Al₂O₃ 5.87, Fe₂O₃ 3.83, CaO 30.63, SO₃ 2.54, CO₂ 10.67, H₂O 28.02%. It is concluded that these inclusions are not related in origin to the calcite-bearing igneous rocks of Ettringen. They are believed to have come from Tertiary limestones.

J. E. GILL

The formation of dolomite, from the standpoint of the sedimentation of primary magnesium carbonate. M. ROZSA. *Centr. Mineral. Geol.* 1926A, 217-33.—Available data indicate that strata of cryst. magnesite result from recrystn. of primary Mg carbonates pptd. from marine solns. contg. Ca and Mg carbonates. The sep. pptn. of MgCO₃ is due to the great difference in soly. between CaCO₃ and MgCO₃·3H₂O and to horizontal differentiation phenomena. Dolomite is assumed to form by: primary sepn. of mixed salts according to local and temporary equil. conditions, with later change to dolomitic stable products; primary sepn. of dolomite; marine dolomitization, i. e., replacement of original organically or inorganically pptd. CaCO₃ due to change in the equil. conditions in the marine system; dolomitization at depth within the earth's crust i. e., rearrangement of original carbonates or replacement by reaction with foreign solns.

J. E. GILL

Recent geology of the northern Fayum desert. ELINOR W. GARDNER. *Geol. Mag.* 64, 386-410(1927).—An analysis of a clay from Tasr-es-Saglia is included.

J. F. SCHAIRER

The mode of formation of hollow limonite pebbles. H. BORGER. *Centr. Mineral. Geol.* 1927B, 1-8.—The hollow pebbles formed from clay-ironstone fragments and geodes. Oxidizing solns. converted FeCO₃ to limonite, decrease in vol. accompanying this change forming the cavities. Some pebbles formed from the original calcareous geodes, the CO₂ freed from FeCO₃ aiding by causing the soln. of calcite. The uniformity of the cavities is due to the migration of Fe⁺⁺ into the porous outer part, where all the Fe is pptd. The banded structure of the crust is due to variations in the O content of the precipitant.

J. E. GILL

Hydrogen sulfide in the carboniferous limestone of the Donetz basin. YA. V. SAMOILOV AND W. A. SILBERMINZ. *Z. deut. geol. Ges. A*, 1926, 315-36.—See C. A. 20, 3673.

J. E. G.

The lime-magnesia waters from the environs of Streithberg and Müggendorf and their separation products. HANS KLÄHN. *Centr. Mineral. Geol.* 1926B, 390-400.—The $\text{CaCO}_3:\text{MgCO}_3$ ratio in the waters is different from that in the tufas sepd. from them. These are pure calcareous tufas, with only a small Mg content, perhaps due to adsorption. For formation of fresh water dolomite, higher MgCO_3 concn., rougher water and the participation of organisms are necessary. The slight pptn. from modern Streithberg waters as compared with the thick sinters of Diluvial time is believed to be caused by a present lower av. temp.

The origin of the thermal waters of Montegrotto (Euganei). L. DE MARCHI. *Atti accad. Lincei* [6], 5, 841-5(1927).—The mineral components of the water and its temp. indicate a source near the surface, whereas the compn. of the gases (H_2S , CO_2 , O, CH_4 , and N) and their vol. indicate a source at a great depth.

The thermal waters of Ax and of Andorra. J. G. F. DRUCE. *Chemist & Druggist* 106, 323(1927).—More than 60 thermal springs, of temp. 18-77°, emit nearly 1,000,000 gallons every 24 hrs., partly alk., partly milky from colloidal S. The compn. of the gas evolved from "Source Viguerie" examd. by Moureu (cf. *C. A.* 18, 3129) is N, 98.45%; A, with traces of Kr and Xe 1.453; He, with traces of Ne 0.097.

The age of the hydrogen sulfide contamination of the sea basin in the Crimea-Caucasus region and its probable connection with the processes of formation of petroleum. A. ARCHANGELSKII. *Neftyanoe Khozyastvo* 10, 483-6; *Chem. Zentr.* 1926, II, 1006.—The same conditions which governed the transformation of org. remains into petroleum govern the formation of H_2S in the mud at the bottom of the Black Sea.

The rare gases of a few thermal springs of Bulgaria. N. P. PENTCHEFF. *Compt. rend.* 185, 511-3(1927).—The gases of 3 springs have been analyzed by the methods used by Moureu and Lepape. The ratios He/A and A/N confirm the results of Moureu

The constitution of the earth. H. S. WASHINGTON. *Bull. volcanologique* 1925, Nos. 5-6, 1-39.—Previous theories and that of the author regarding the constitution of the earth are summarized in detail. For a similar but more detailed presentation of W.'s theory of the constitution of the earth, cf. *C. A.* 19, 2012.

Geochemistry of iodine. III. The distribution of iodine between the iron and silicate melt. TH. VON FELLEBERG AND GULBRAND LUNDE. *Biochem. Z.* 187, 15-8(1927); cf. *C. A.* 21, 3034.—The slag contains more I_2 than the Fe melt.

The chemistry of coal (WHEELER) 21. Estimation of CO_2 and of carbonates in solution. Application to the determination of CO_2 in mineral waters (NICLOUX) 7. The rotating crystal method (SCHIEBOLD) 3. X-ray analysis of Cr-C systems (WESGREN, PHRAGMÉN) 2. The analytical and graphical methods of study of the equilibria of complex systems [in mineral springs] (SHISHOKIN) 2. The evolution of mineral substances and the analytical applications (JOUNIAUX) 7. Pt and the regions in which it is produced (VUISOTZKII) 9. The chemical structure of the natural hydrates of ferric oxide (KURNAKOV, RODE) 2. The structure of xenotime (VEGARD) 2. Colloidal chemistry of coal (WINTER) 21.

NIGGLI, PAUL: *Tables on General and Special Mineralogy*. Berlin: Borntraeger. 300 pp. Reviewed in *Mineralog. Abstracts* 3, 319(1927); cf. *C. A.* 21, 2637.

BYELYANKIN, D. S., NIZKOVSKII, P. L., AND PRIOBRASHENSKII, I. A.: *Collection of Tables for the Determination of Minerals*. Leningrad: The authors. 151 pp. Reviewed in *Mineralog. Abstracts* 3, 320(1927).

9—METALLURGY AND METALLOGRAPHY

D. J. DEMOREST, R. H. ABORN

Alfred Krupp, 1812-1887. W. BERDROW. *Krupp. Monatsh.* 8, 22-4(1927).—Biographical sketch.

How selective flotation is affecting metallurgical practice. L. O. HOWARD. *Eng. Mining J.* 124, 551-2(1927).

Organic flotation reagents. J. C. WILLIAMS. *Eng. Mining J.* 124, 456-8(1927).—A brief explanation of the chem. compn. of org. flotation reagents. Oils employed have been classed as "frothers" and "collectors." The former includes such compds. as pine oil, while the "collectors," such as coal tar and the heavy mineral oils, have

recently been largely superseded by certain org. chemicals, known as "promoters." Of the 4 reagents discussed, 3 contain a —SH group and the other contains N in an amine group. Compds. contg. both N and S are known that are extremely effective flotation promoters, and most of the org. promoters also effectively vulcanize rubber. W. H. B.

Investigations of the magnetizability of the roasted products obtained by heating magnetite in the air and the relation between this capacity and their chemical composition. E. GREULICH. *Glückauf* 62, 1297-305; *Chem. Zentr.* 1926, II, 2629; cf. C. A. 21, 869.—The magnetizability of the roasted products depends upon the Fe_3O_4 content. The exponential law which applies to the decrease in the Fe_3O_4 content on roasting is also applicable to the decrease in the magnetizability. Even below 550° a decrease in the magnetizability was detected. Above 1400° magnetite is stable. Above 1450° in the presence of Pt it forms free FeO , which was identified by means of magnetic measurements. There is no strict proportionality between the magnetizability and the Fe_3O_4 content. The magnetic method is therefore not suitable for accurate quant. analysis, but does give some information on the possibility of working an ore. For other ores, such as pyrites, it must be considered that certain conditions are indispensable in the roasting of the ore to Fe_3O_4 . C. C. DAVIS

Concentration of the mixed copper-zinc-lead ores at the mines of Orijärvi, Finland. KNUT MÖRTSELL. *Teknisk Tidskrift, Upplaga C (Bergsvetenskap)* 57, 5-7(1927).—A review. C. A. ROBARK

The treatment of Read-Rosebery ore at Zeehan, Tas. E. H. FRASER. *Chem. Eng. Mining Rev.* 19, 361-5(1927).—The ore from the mines at Williamsford and Rosebery consists, in general, of a very finely grained mixt. of sphalerite, galena and pyrite with a gang of quartz and schistose material, and contains about 30 g. of Ag to the unit of Pb. For sepn. it is necessary to grind the ore so that 90% passes a 200-mesh screen. Conc'n. of the ore, conditions for Pb and for Zn flotation, and the need and means of accurate plant control are discussed. Careful control of temp. is necessary to minimize the volatilization of Pb and the formation of Zn ferrate from the blende and pyrite present in the concentrate. The presence of ferrate adversely affects the extn. of Zn in the electrolytic process. It begins to form freely above 750° . Research work is in progress relative to the reduction of ferrate formation. W. H. BOYNTON

Smelting titaniferous ores of iron. ALFRED STANSFIELD. *Iron Steel Can.* 10, 263-7, 271(1927).—The principal Canadian deposits of titaniferous iron ores are briefly described. Magnetic concn. does not sep. the iron from titanium. Much more fuel per ton of iron produced is required for titaniferous ores than for hematites. By making cones contg. TiO_2 , SiO_2 and CaO in varying proportions together with 10% Al_2O_3 in each mix the limiting percentage of each variable to produce a low-melting slag (1185 – 1210°) was detd. In the presence of N_2 , however, the cones when heated to 1400° or over were coated with a difficultly fusible Ti nitride. The dark blue oxide of Ti is not Ti_2O_3 , but probably Ti_4O_7 . When TiO_2 is heated in a C boat at 1600° in a stream of $\text{CO} + \text{N}_2$ a black substance, probably Ti carbide, is formed. Above 1600° the oxide is converted into a copper-colored substance, possibly Ti_3CN_4 . On contact with C the molten slag effervesced and gradually became less fusible. Possibly nitride, as well as TiC , was formed. Titaniferous ores have often been smelted in blast furnaces, but the TiO_2 content of the mixed ores must be kept below 1.5% for foundry iron and below 3% for malleable iron. By the magnetic concn. of titaniferous magnetites the TiO_2 content can be brought down to 5 to 10%. By mixing such a beneficiated ore with siliceous ores, it may be possible to smelt it economically. Mixing magnetite and hematite is not desirable, but the concentrates when sinter-roasted will probably be easily reduced and can therefore be smelted in admixture with siliceous hematites or the production of a superior grade of pig iron. E. G. R. ARDAGH

Treatment of Rouyn copper ores. H. H. CLAUDET. *Can. Mining J.* 48, 751-3(1927).—The different types of ore met with in the Rouyn district are discussed and a method of treating the chalcoppyrite ore is considered. Tables are given showing probable profits with direct smelting compared with smelting preceded by concn. A. B.

Treatment of Horne copper-gold ores. K. WILLIAMS. *Can. Mining J.* 48, 768-70(1927).—The process will consist of roasting in shaft furnaces, smelting to 35% mat in reverberatory furnaces, and converting in Peirce-Smith converters. The smelter stack will be of brick-lined concrete, 422 ft. high. The plant is under construction. A. B.

Flotation test on a copper-nickel ore. A. C. HALFERDAHL. *Can. Mining J.* 48, 608-9(1927).—Attempts were made to float Cu-Ni selectively from pyrrhotite in a Manitoba ore, aided in some cases by magnetic sepn. The association of Ni and Cu with pyrrhotite was broken up only at meshes finer than 200. It was impossible to make a high Ni concentrate without grinding to slime. A. BURRS

An application of froth flotation to oxide ores. A. C. VIVIAN. *Mining Mag.* 37, 153-60(1927).—An account of expts. made in a study of differential flotation of Pb and Zn minerals in oxidized Rhodesia Broken Hill ore. Further discussion is also given of the use of cupferron, KCN, NaCN, taurocholate and other reagents. Cf. C. A. 21, 3177. Results were encouraging but not conclusive. A. BUTTS

Direct production of brass from mixed ores. A. W. GUERTLER. *Metall u. Erz* 23, 325(1926).—PbS and ZnS ores may be roasted with an excess of metallic Cu to produce an upper layer of Cu_2S and two lower layers of Pb-Cu and Zn-Cu. Remelting the Zn-Cu with addition of more Cu produces a machine grade of brass. The Pb-Cu can readily be refined to Pb. Cu_2S can be roasted to reproduce Cu. Fe may be removed as a slag, and small amts. of As, Sb and Bi go with the Pb fraction. C. G. KING

Native smelting in equatorial Africa. J. C. BOWER. *Mining Mag.* 37, 137-47 (1927).—The crude methods used for Fe and Cu are described. A. BUTTS

The dispersoid chemical factor in metallurgy. F. SAUERWALD. *Kolloid-Z.* 42, 242-63(1927).—The high surface tension of metals causes a difficult problem in sepg. them from the slag. The limit of grain size of both boundaries and internal parts of a solid metal is discussed. Change in form of crystals can be noticed by measuring the expansion on heating. The general idea of the relation between boundary and inner portion of a metal is reviewed; its independence of temp., the properties of mixed crystals with respect to the degree of despersity and tempering are big factors in obtaining a desired metal. R. H. LAMBERT

Nickel—past and present. R. C. STANLEY. *Can. Mining Met. Bull.* No. 183, 844-77(1927).—An historical sketch of the use and production of Ni, with details of modern uses and alloys. A. BUTTS

Some characteristics of certain New Guinea gold. R. LAW. *Chem. Eng. Mining Rev.* 19, 370-1(1927).—The types of Au obtained from this field are roughly classed as: (a) melted Au in ingots, buttons, etc.; (b) unmelted Au recently roughly sepd. from quartz and gang; (c) water-worn stones and pebbles carrying precious metals; (d) alluvial dust grains, slugs or small nuggets with a fine Au color. Characteristics of each class are noted. The peculiarities of New Guinea Au are due to an etched or plated external surface. There is a Au in the stone of low fineness (53.6% with Ag as the alloy). There is the metal being sepd. from the gang by weathering and mech. action and simultaneously being superficially acted on by solvents. And there is the coalescence of the fine Au surfaces. The alluvial nuggety Au varying in fineness from the outside inwards is of scientific interest. W. H. BOYNTON

Making sponge iron in Japan. ANON. *Iron Age* 120, 937-8(1927).—A description of a plant built at Kuji and an account of experience with the Anderson-Thornhill process in the reduction of the ferrous sands of the district. E. J. C.

Need for research in foundry pig iron. RICHARD MOLDENKE. *Am. Inst. Mining Met. Eng. Tech. Publication* No. 11, 1-11(1927).—The gradual decrease, in recent years in the quality of pig irons for foundry use, is laid to the ever-increasing demand for pig irons to be used in the production of com. steel. Concn. by furnace men upon steels for the latter purpose has made it increasingly difficult for the foundryman to obtain good casting iron. Since considerable oxidation takes place when the metal is melted for casting, it is absolutely essential in order to get good castings that the pig Fe used be one that has not been subjected to any oxidizing influences at the furnaces. A process for deoxidation of molten foundry Fe would overcome this difficulty, and of course, would be highly desirable. New methods of analysis and more detailed reports of compn. including such constituents as: O_2 of dissolved Fe oxide, occluded O_2 , H_2 and N_2 , Cr, Cu and Ni, would lead to a better knowledge and perhaps an elimination of the troubles arising in foundry practice. A cooperative research program, by furnacemen and foundrymen, is urged. An excellent discussion of the paper is appended. W. F. E.

Pig iron low in total carbon is in demand for use in various industries. ENRIQUE TOUCEDA. *Am. Inst. Mining Met. Eng. Tech. Publication* No. 11, 24-7(1927).—In the production of air-furnace, white-iron castings in which high strength and ductility are desired, the C content should not exceed 2.5% in order that the C in the annealed casting will be sufficiently low. For higher strengths less C should be used. The most satisfactory way of obtaining castings so low in C would be to start with pig Fe having about 3% C. This cannot now be obtained from the blast furnace proper but could be made by an auxiliary installation in the cast house. Addition of steel scrap to lower the C content of pig Fe to be used in the malleable process is not satisfactory because of the impurities which may be introduced thereby. WILLIAM F. EHRET

Carbon in pig iron. R. H. SWEETSER. *Am. Inst. Mining Met. Eng. Tech. Publication* No. 11, 28-37(1927).—Data recorded during several "casts" at the blast fur-

naces of the American Rolling Mills are presented. Basic Fe was being made with by-product coke. The aim in the investigation was to find out how to control the C content of pig Fe and to det. the connection between the analysis of the gas at the tuyères, the analysis of the slag and pig Fe and the temp. of the slag and Fe. For a particular Fe the C and Si tend to increase with increased temp. in the furnace, and the S decreases. The temp. interval was between 2500° and 2700° F. Analysis of samples taken at the tuyères shows that the reactions which det. the character of the slag and of the Fe only are partially complete at the level of the tuyères. Much chem. action takes place between the level of the combustion zones in front of the tuyères and the molten Fe in the bottom of the furnace.

WILLIAM F. EHRET

Proper sulfur-manganese ratio must be maintained. L. E. GILMORE. *Foundry* 55, 734-5 (1927).—A discussion of the importance of the relation between S and Mn to produce good malleable iron. Two charts show the Mn-S relation in the usual air-furnace, open-hearth or elec. malleable, and for cupola malleable, and serve as a practical guide for detg. rational % of Mn for varying S contents in the iron cast. The presence of FeS is responsible for most of the troubles and a correct Mn-S ratio prevents its formation. In the air-furnace, open-hearth or elec. furnace malleable, the recommended ratio is % Mn = $1.7 \times \% S + 0.1$, and for cupola malleable it is % Mn = $1.7 \times \% S + 0.2$. In all cases the min. is % Mn = $1.7 \times \% S$. The chart indicates that Mn should be $2\frac{1}{3}$ times the S to produce good black-heart iron.

W. H. B.

Fundamental research in steel manufacture. C. H. HERRY, JR. *Trans. Am. Soc. Steel Treating* 11, 899-911 (1927).—Particular reference is made to slag-metal reactions resulting in the formation and elimination of non-metallic inclusions formed from Mn, Si and Al.

W. A. MUDGE

The quality of steel as dependent upon the method of production. P. GOERENS. *Krupp. Monatsh.* 8, 25-48; *Z. Ver. deut. Ing.* 70, 1093-9, 1129-36, 1194-8 (1927).—A review.

C. G. F.

Centrifugal casting of steel. LEON CAMMEN. *Trans. Am. Soc. Steel Treating* 11, 915-19 (1927).—A discussion of the present and prospective field of application and limitations of centrifugal tube casting is followed by an application to centrifugal bar casting. Steel made by this latter method is both better in quality and cheaper than that made by present methods.

W. A. MUDGE

Direct production of steel from minerals. REMO CATANI. *Met. italiana* 19, 146-59 (1927).—The topics treated are: elec. processes, non-elec. processes, direct and indirect reduction of Fe minerals in the elec. furnace, reduction equations of magnetite, results of direct production of steel from magnetite, reduction of hematite in the elec. furnace.

ROBERT S. POSMONTIER

The theory of the blast-furnace process. FRITZ WÜST. *J. Iron Steel Inst.* (advance copy), Sept., 1927, No. 15, 13 pp.—It is shown that Mn, Si and P cannot be taken up by the iron in any quantity in the blast-furnace bosh. Dissoen. of CO is regarded as essential for economical working, and since dissoen. is considerable only below 500° a low top temp. is desirable in the blast furnace—a condition causing sepn. of C in large quantities, and emphasizing the favorable effect of the hot-blast. The heat evolved in conjunction with the dissoen. of the CO delays the temp. fall within the shaft and permits the indirect reduction to take its course more fully. The theoretical considerations have been fully confirmed by a practical test. In the oxidizing gas phase in front of the tuyères oxidation of the iron takes place, whereby the slag becomes charged with FeO, which inhibits reduction of MnO, SiO₂ and P₂O₅ from the slag. Reduction of these oxides is effected above the level of the tuyère. Si, Mn and P diffuse into the iron before melting in the same way as C, which means that the pig iron is formed before the iron melts. C evolved by dissoen. of CO penetrates the pores of the ore, tending to promote reduction. Also in *Engineering* 124, 436-8 (1927).

W. H. BOYNTON

Alkalies in the blast furnace. WILLIAM MACCONNACHIE. *J. West Scot. Iron Steel Inst.* 39, 79-84 (1927).—A review of the work of others on cyanogen and alkalies in blast-furnace gases is followed by data indicating the considerable accumulation of alkalies at the tuyère level. The alk. cyanides are destroyed by contact with unreduced oxides causing oxidation of both the C and the alk. metals of the cyanide. The alk. oxides so formed may be in the vapor state or in suspension in the gases and combine with SiO₂, MnO, Al₂O₃, etc. to form easily fusible compds. which trickle down, over or through the materials, eventually reaching the bath of slag and metal in the hearth. Here Ca replaces the alkali and the latter rises from the slag and is driven against the C undergoing combustion and is reconverted into cyanide. This reaction may not be complete, as some of the alkali may combine with CO₂. In connection with the reduction of Mn, the interception of alkali shows its greatest distribution effect. As the gases

rise in the furnace the amount of alkali diminishes and the cyanide content diminishes even faster. "The alkalis are not simply condensed but are intercepted and brought back to the hearth by silica and alumina chiefly." In a hot furnace in good order the alkali forms mostly cyanide which will rise the higher in the furnace the more thoroughly the ore has been reduced in the upper part. A brief discussion is given.

W. H. BOYNTON

The use of silica gel as a medium for drying blast. F. H. LEWIS. *J. Iron Steel Inst.* (advance copy), Sept., 1927, No. 9, 10 pp.—At the Wishaw works of the Glasgow Iron & Steel Co., Ltd., a silica-gel plant of 6 adsorber units has been operating since April, 1927. Each unit consists of a large steel box with trays contg. the gel in granular form. The bottoms of the trays are so perforated as to cause the air to flow through them in parallel. Five units are normally used for adsorption and the other is used for activation. The heat for activation is provided by the combustion of blast furnace gas, cleaned in the recovery of by-products from the raw coal used in the furnaces. Between the dehydrating plant and the blower an adjustable inlet for atm. air permits diln. of the dried air to the required moisture figure. Const. moisture in the blast permits the production of a more regular quality of iron, and saves fuel. Historical notes and a bibliography are appended. Also in *Chemistry & Industry* 46, 902-4; *Ind. Chemist* 3, 441-51; *Chem. Age* (London) 17, 281 3(1927).

W. H. BOYNTON

Basic open-hearth practice. C. H. HERTY, JR. *Trans. Am. Soc. Steel Treating* 11, 569 82(1927).—A comparison covering the melting period, lime boil, working period and the efficiency of the deoxidizers used for 3 types of open hearth charges, consisting, resp., of light scrap, heavy scrap and ore

W. A. MUDGE

The effect of varying ash in the coke on blast-furnace working. C. S. GILL. *J. Iron Steel Inst.* (advance copy), Sept., 1927, No. 5, 7 pp.—G. shows the effect of fluctuating ash and the advantages of consistent ash on quantity and quality of pig iron produced, the saving in blast pressure, and the reduction in coke consumption. Also in *Gas World* 87, No. 2252, Coking and By-products Section, 33-4(1927); *Engineering* 124, 435(1927).

W. H. B.

Manufacture and use of metallurgical coke. R. BULMER. *Bull. Brit. Cast Iron Research Asscn.* No. 17, 19-20(1927).—A brief discussion of the chem. and phys. requirements of blast-furnace and cupola cokes. Many chem. requirements are common to both, but aside from strength, their phys. requirements diverge. While a large, slow-burning coke is desirable in the cupola, the opposite qualities are desired in the blast furnace.

R. H. ANORN

Improved furnace on southern ores. J. P. DOVEL. *Iron Age* 120, 782-4(1927).—More uniform stock distribution and corresponding gains in tonnage and lower ratio coke are effected by having steeper inwalls that are water-cooled. The blast-furnace construction at the Sloss-Sheffield Steel and Iron Co., Birmingham, Ala. is described and illustrated. A heavy cast sectional iron hearth jacket is employed and its size is detd. rather by the size of the cast than by other general dimensions of the furnace. Inwall is protected by several rows of bronze cooling plates connected to and supported by the shell. An independent brick lining is used up to a point where abrasion from the stock would commence. Above this the wall is of metal. Advantages claimed for the furnace are: a larger area for stock; the possibility of using a relatively smaller bell, which results in throwing more coarse material to the walls and causes free work along the wall as well as through the middle; and greatly increased production with a lower coke consumption.

W. H. BOYNTON

Reverberatory furnace burning powdered coal for melting cast iron. O. BECKMANN. *Feuerungstech.* 15, 281-3(1927).—A furnace and mill are described and illustrated.

ERNEST W. THIELE

Equilibria among lead, oxygen and sulfur. R. SCHENCK. *Metall u. Erz* 23, 326 (1926).—The system Pb-O-S is complicated by the vapor pressure of PbS and by the formation of basic sulfates. There are 26 possible reactions in the system and 8 or 9 of the possible curves can be established.

C. G. KING

Platinum and the regions in which it is produced. I-IV. Ural and Siberia platinum fields. N. K. VUISOTSKII. *Separates* (Petrograd) 1923-5.—I. A compendium of the history, uses, av. prices, trade conditions and the resources of Pt. II and III. Minerals and ores of the Pt group and the geology of Pt are described in great detail. IV. The Ural Fields are described.

WILLIAM M. MALISOFF

Cathodic disintegration as a method of etching specimens for metallography. C. S. SMITH. *J. Inst. Metals* (advance copy), No. 438, 3 pp.; *Engineering* 124, 410(1927).—Cathodic sputtering is employed to develop the structure of specimens for microscopic examn. Ag-Cu alloys gave the best results. Its use is limited to alloys of duplex struc-

ture, the constituents of which differ in ease of sputtering. This method should be useful as a confirmation of other methods in cases where the interpretation of etching results is difficult.

R. H. ABORN

Effect of temperature on the properties of metals. G. W. SAATHOFF AND F. M. VAN DEVENTER, *et al.* *Mech. Eng.* **49**, 1111-4 (1927).—A report of progress made by the Joint Research Comm. on the Effect of Temp. on the Properties of Metals. The research work is sponsored by The Am. Soc. of Mech. Engineers and the Am. Soc. for Testing Materials. The results of thermal expansion tests, over the range 0-500°, are given for the following alloys: 0.17 C-steel, stainless steel, Cr-Mo steel and nichrome. Av. and instantaneous coeffs. of expansion are given for each alloy at 100° intervals. Equations for calcg. the coeffs. of expansion are presented. A comparison of the data obtained from high-temp. tension tests by different labs. shows that there is a considerable variation in the results obtained by different labs. when working with the same sample of metal.

WILLIAM F. EHRET

A method of measuring variations of electrical resistance for the determination of the thermal equilibrium diagram of an intermetallic system. F. H. JEFFERY. *Trans. Faraday Soc.* **23**, 563-70 (1927).—A continuous method of measuring the change of elec. resistance of an alloy with change in temp. has been described. The method has been applied to the series of Cu-Sn alloys from 40 at. % Sn to 98 at. % of the same. The results are in almost complete agreement with those obtained by Heycock and Neville but not in accord with those obtained by Ishihara (*J. Inst. Met.* **1**, 315 (1924); cf. *C. A.* **19**, 920) nor with those obtained by Haughton (*C. A.* **15**, 1686). The higher transition point of Sn, as detd. by this method, is 162°.

A. I. HENNE

The application of recrystallization. M. v. SCHWARZ. *Z. Metallkunde* **19**, 321-4 (1927).—Photomicrographic analysis is made of sections where failure had occurred, and by means of *Fry's etching medium*, the presence of recrystn. and grain growth at the defective sections is demonstrated. A sample of cast Fe is heated and the variation in Brinell hardness as the temp. rises is detd. The hardness decreases almost on a straight line up to about 300°; from 300° to 400° the rate of decrease is much lower; and above 400°, as the depth of recrystn. increases, the Brinell no. rises.

H. STOERTZ

Aluminum destruction by mercury and its remedy. H. RÖHRIG. *Korrosion und Metallschutz* **3**, 121-3 (1927). On Al immersed in 92% soln. of HgCl₂ a thin layer of Hg quickly formed. After being washed and dried, the Al was exposed to moist air, which caused the formation of Al(OH)₃ with evolution of much heat. After immersion, test pieces were treated to prevent corrosion in moist air. Washing with water and scraping were unsuccessful; treatment with HNO₃ was partly successful. Annealing was completely successful but is not advisable in practice because of the redeposition of volatilized mercury in cold parts of the app. One or two treatments with a 10% K₂Cr₂O₇ soln. is recommended as the best remedy.

J. K. ROBERTS

Hysteresis in metals under alternating stresses. N. P. INGLIS. *Metallurgist*, Supplement to *Engineer* **144**, Sept., 1927.—A review.

D. B. DILL

Notes on the A₂ stable transformation. A contribution to the subject of graphitization. H. A. SCHWARTZ. *Trans. Am. Soc. Steel Treating* **11**, 767-70 (1927).—A₂ stable is distinctly below A₁ metastable. The theory is offered that A₂ stable approaches A₂ in pure Fe-C alloys as the concn. of the element promoting graphitization decreases.

W. A. MUDGE

Corrosion-fatigue of metal, as affected by chemical composition, heat treatment and cold working. D. J. MCADAM, JR. *Trans. Am. Soc. Steel Treating* **11**, 355-79 (1927).—Corrosion-fatigue depends upon 2 factors—corrosion intensity and a stress range. The corrosion-fatigue limit depends upon a strength factor as well as on corrosion resistance. Data are given for C, Ni, high-Cr and Cr-Ni steels. Transverse cracks passing through non-metallic inclusions usually surrounded by oxide coating are the origins of corrosion-fatigue failures.

W. A. MUDGE

Inter- vs. intra-crystalline fracture in systems of large crystals of aluminum, iron, copper and brass in relation to temperature and time as well as resulting recrystallization. F. SAUERWALD AND G. ELSNER. *Z. Physik* **44**, 36-57 (1927).—Static and impact tensile tests at temps. up to 650° for Al, 800° for Fe, 900° for brass and 1000° for Cu failed to show any general relationship between temp. and type of fracture. Al and Fe gave only intra-cryst. fractures, while Cu and brass exhibited both types. The occurrence of inter-cryst. fracture in these cases is connected with the known small deformability of Cu and brass crystals in certain regions, and need have nothing to do with grain boundary conditions. Spontaneous recrystn. occurring during hot deformation and tending to diminish the brittleness accompanying inter-cryst. fracture complicates the problem at high temp.

R. H. ABORN

Nickel and Monel metal with especial reference to annealing. C. A. CRAWFORD. *Am. Inst. Mining Met. Eng., Tech. Publication No. 35*, 21 pp. (1927).—A paper giving the com. forms of Ni and Monel metal, their chem. compn., phys. and mech. properties, and their working and fabrication. Details in annealing practice are given and the behavior of these metals in forging, casting, pickling, machining, punching, press drawing, hand-hammering, spinning, soldering, brazing, welding and riveting described. An appendix follows the paper, giving details as to the specific uses of the different classes of com. Ni and Monel metal. J. W. SHIPLEY

The hardening of metals by dispersed constituents precipitated from solid solutions. R. S. ARCHER. *Trans. Am. Soc. Steel Treating* 10, 718-47 (1926).—Metals may be hardened by highly dispersed particles within the grains, such as may be formed from super-satd. solid solns. The typical process of hardening by this means consists in a soln. heat treatment at a relatively high temp. followed by rapid cooling into a region of super-satn. then by a pptn. treatment or aging to permit the formation of a very fine ppt. The ppt. tends to grow to a crit. particle size conducive to max. hardness, beyond which the hardness decreases. Various examples of this type of hardening and generalization regarding the theory of the process are offered. W. A. MUDGE

Twinning in ferrite. L. W. MCKEEHAN. *Am. Inst. Mining Met. Eng., Tech. Publications*, No. 29, 7 pp. (1927).—M. describes the prepn. of twins in large ferrite crystals in a $\frac{1}{8}$ in. Armeo Fe welding rod contg. C 0.04, S 0.037, P 0.003, Si 0.008 and Mn 0.02%. No change in the cryst. boundary was produced on heating for 3 hrs. at 700°. Conclusion: Distortion at the twin boundary is therefore not sufficient to cause the growth of new crystals. Twin boundaries in ferrite are more stable than those in Zn. J. W. SHIPLEY

Correlation of magnetic properties with mechanical hardness in cold-worked metals. II. Nickel strip. S. R. WILLIAMS. *Trans. Am. Soc. Steel Treating* 11, 885-98 (1927).—The hardness obtained by cold-rolling Ni strip has been studied in connection with the change of length due to a magnetic field (Joule magnetostriuctive effect), the coercive force, residual magnetism, hysteresis loss per cycle and elec. cond. All magnetic phenomena except the magnetic change in length continued to vary as the Ni increased in hardness on cold rolling. The magnetic change in length did not vary after 30% cold reduction. W. A. MUDGE

Grain growth in compressed metal powder. C. J. SMITHIELLS, W. R. PITKIN AND J. W. AVERY. *J. Inst. Metals* (advance copy), No. 441, 13 pp. (1927).—Tungstic acid was purified and reduced by H so as to give two grades of pure W powder differing in fineness. The powders were pressed into bars and sintered electrically at temps. measured with a disappearing-filament pyrometer. The relation between the temp. of the bar and the wattage required for heating was plotted; a discontinuity appeared on every heating curve, at a higher temp. for the coarser than for the finer powder. The shrinkage in length of bar was greater for the fine than for the coarse metal; with the finest powder it was detected first at 1100° K., and with the coarsest at 1420° K. Metallographic tests showed that the changes at definite temps. were due to grain growth. Greater pressure in forming the bar caused grain growth to occur at a lower temp. It is concluded, contrary to Sauerwald, that grain growth in pressed W powder occurs at temps. depending on the pressure and particle size. GEO. F. COMSTOCK

Chemical and physical properties of non-ferrous castings. S. R. FRANCIS. *Pulp Paper Mag. Can.* 25, 1140-1 (1927).—A brief outline of the most important chem. and metallurgical features affecting the selection and purchase of bronze for various services in the pulp and paper industry. A. PAPINEAU-COUTURE

The scientific conception of some properties important in the casting and hot working of metals. F. SAUERWALD. *Z. Metallkunde* 18, 137-42, 193-5 (1926).—The properties of liquid metals and alloys are considered and their relation to the crystn. of the metal when cast and to the solid castings so formed. Among these properties are the vol. changes in the liquid and the solid metal, the effects of internal friction and of so-called "turbulent friction" and their relation to surface tension and viscosity. App. for measurement of viscosity and internal friction up to 1000° is described. No special dependence of internal friction upon compn. was found and Plüss' conclusion that the concn. corresponding to the eutectic shows a min. value for internal friction was not confirmed. Some alloys contg. Cu₃Sn showed high internal friction, presumably due to the complex compd. present. Surface tension of liquid metals was measured by passing a gas stream through a quartz capillary tube dipped beneath the surface of the melt metal so that the single bubbles of gas escaped very slowly. The pressure required just to allow the gas to pass through the surface and form bubbles was measured; with uniform capillary diameter and depth of immersion this is proportional to the surface tension. The mol.

condition in liquid and solid metals was investigated. Two of the most important alloy series, the iron-carbon and the bronzes, have intermetallic compounds and there is an equil. between these and their dissoen. products which is dependent upon temp. Whether the shifting of this equil. follows the temp. when the temperature is rapidly changing, as during casting of the metal, can sometimes be detd. from the vol. changes during fusion. A graphical method of estg. the degree of dissoen. of a liquid intermetallic compd. by use of its vol. isotherms is described and illustrated. Characteristic results given for copper show a linear relation between temp. and deforming stress with test pieces of various shapes. Recrystn. following hot working was studied and the temp. and duration of working as well as the rate of cooling. The final structure depends primarily on the rapidity of crvstn., the amount of deformation, and the rate of cooling. Development of large crystals after hot working was observed in specimens of Cu, Ni, Fe, Al, Sb, Zn and brass. The temp. at which marked crystal growth followed light cold working and the velocity of the changes were noted, the phenomena being observed immediately after working and (1) quenching in H_2O , (2) after natural cooling and (3) after annealing the forged test pieces, half an hour, at the temperature of working. Results with Cu and Ni are graphically shown, together with photomicrographs of treated Cu and brass. Cu begins to cryst. rapidly at 700° . Ni shows the influence of time, and the end effect of deformation and recrystn. depends on the rapidity of cooling as well as the duration of annealing. A 63% brass worked above the β transformation range and then quenched in water shows a coarse structure at the points of least work.

D. F. McFARLAND

Effect of heat treatment on the combined carbon in gray cast iron. E. L. ROTH. *Trans. Am. Soc. Steel Treating* 12, 27-40(1927).—Max. transformation of combined C in gray cast Fe, into graphitic C, occurs at $1400^\circ F$. when the cast Fe is heated for $1/2$ to 3 hrs. in the case of materials contg. 3.52% C and 1.75% Si as well as those contg. 3.25% C and 2.70% Si. The degree of graphitization does not increase with a rising temp. and is more complete at the center than at the edge. Si does not have a marked effect upon the graphitization.

W. A. MUDGE

A neglected phenomenon in heat treatment. BIRGER EGEBERG. *Trans. Am. Soc. Steel Treating* 12, 46-50(1927).—Quenching Ni-Cr Steels in which there is considerable difference between the Ac and Ar points, at a temp. close to the Ar point rather than the Ac point gives better phys. properties and less dimensional change. W. A. M.

The embrittlement of black-heart malleable iron resulting from heating overstrained material. R. D. ALLEN. *Trans. Am. Soc. Steel Treating* 10, 630-7(1926).—Restructured bars of black-heart malleable Fe, when heated within the range $440-800^\circ F$. and cooled in air, become extremely brittle and fracture with a white steely fracture. This defect may be eliminated by quenching in water from $1200^\circ F$.

W. A. MUDGE

Case-hardening materials, their composition, investigation and valuation. P. W. DOHMER. *Z. angew. Chem.* 51, 725-45(1927).—Proximate, rather than ultimate, analyses of case hardening materials are most desirable. Such materials may contain (1) a C-contg. portion, like charcoal, lignite, coal, coke, sawdust, animal charcoal, etc.; (2) a catalyzer or energy-carrier, such as $CaCO_3$ or $BaCO_3$; (3) CN compds., like KCN, $K_4Fe(CN)_6$, $CaCN_2$, etc.; (4) a binding material, such as glue, dextrin, soap, oil residues, mineral waxes, etc.; and (5) other additions of questionable value like SiO_2 , NaCl, glass, KNO_3 , iron scale, slag, ash, etc. Cyanides, binding materials and other additions are rarely found in hardeners bought and used by the car-load, but are employed in small-scale operations. If the sp. gr. of the material is low (0.360) it indicates high percentages of charcoals; if it is high (near 0.830) it indicates the presence of coke in large amts. The H_2O content is important; it is detd. by the xylene method. Na_2CO_3 is detd. by titration of an aliquot portion of the soln. obtained by leaching a sample with H_2O . Alkaline earth metals are detd. by pptg. HCl solns. of case-hardening materials with alkali carbonates, drying the ppts and then weighing. The residue from these extns. with H_2O and HCl is then "slimed" with H_2O and sepd. into lighter (wood, peat, charcoal, etc.) and heavier (coal, coke, etc.) materials, and then examd. microscopically. H_2O content of 6-8% is normal; sp. gr. must not be too high; charcoal must always be present, 10% being considered optimum; Na_2CO_3 is sometimes a detriment, for it unites with SiO_2 to form silicates (glass). A mixt. of equal parts of $CaCO_3$ and $BaCO_3$ (up to 12-16% of the total wt.) acts better than either carbonate used alone, because of their different temps. of decompn. Wood, peat and many other substances are ineffective, and are added simply as fillers to keep down costs. Dextrin and mineral wax are sometimes used as binders, thus affording a product in pellet form. W. C. E.

Nature of the magnetic transformation of iron. FRANZ WEVER. *Z. anorg. allgem. Chem.* 162, 193-202(1927).—The A_3 and A_4 transformations of Fe are shown

to be both polymorphic and phase transformations as defined by W. In the magnetic A_2 transformation, neither the space group, the crystal structure, nor the space lattice orientation within the individual crystals is changed. Hence the magnetic transformation is not polymorphic. Further, the cooling curve for very pure Fe is interpreted as failing to establish the A_2 as a phase transformation. W. W. STIFLER

Behavior of carbon in a high-chromium rustless iron. M. A. GROSSMANN. *Trans. Am. Soc. Steel Treating* 10, 436-46 (1926) —C in a high-Cr Fe was found to be distributed non-uniformly after heat treatment; this leads to the formation of separate austenitic areas, in equil. with regions of α -Fe. The metal is still soft after rapid quenching from a high temp. because most of it has remained as α -Fe; the ductility has decreased greatly because C has led to the formation of well-distributed austenite areas, which upon quenching become martensitic and therefore hard and consequently interfere with deformation. Photomicrographs show typical structures. W. A. MUDGE

Evidences concerning the location of the carbon atom in boydenite. H. A. SCHWARTZ. *Trans. Am. Soc. Steel Treating* 11, 277-83 (1927). — Boydenite is a soln. of C in γ -Fe, in which one atom of the C replaces one of the Fe in the face-centered cubic arrangement. A solute atom of any kind may occupy either of 2 types of location in the lattice of a given solvent. W. A. MUDGE

Carbon characteristics of copper-bearing pig iron. W. B. COLEMAN. *Am. Inst. Mining Met. Eng., Tech. Publication* No. 11, 12-23 (1927). — The presence of less than 1% of metallic Cu in pig Fe does not seem to alter the phys. properties of castings and test pieces of the Fe. Photomicrographs and tests of the phys. properties show that Cu-bearing pig Fe can be remelted and cast without appreciable change in the structure or properties. Such Fe can be used in small castings and in machines satisfactorily. It has a low Brinell hardness, high total C and shows up well under transverse and deflection tests. Complete data on operation, analyses of casts and slags and control of a furnace producing Cu-bearing pig Fe is given. The presence of ferrite in the final structure minimizes internal shrinkage and facilitates machining. W. F. E.

Solution of cementite in α -iron and its precipitation. J. H. WHITELEY. *J. Iron Steel Inst.* (advance copy), No. 14, 11 pp (1927) — Basic steel of the "Armco" type, acid steel plate heated to 1000° and air-cooled, and acid steel plate heated to about 1400° and cooled very slowly were the specimens examd. The results indicate that above 630°, α -Fe dissolves an appreciable amt. of cementite, which is retained in solid soln. on quenching. On tempering at or below 250°, pptn. of this cementite occurs in the ferrite grains, and on further heating the cementite particles travel to the grain boundaries at high velocity. The soly. of cementite increases above 630°, being about 0.03% at 720°. Decrease in purity of the ferrite slightly raises the initial temp. of soln., the acid steel samples showing no soly. below 750°. Photomicrographic examn. shows that the carbide pptd. at lower temps. was always uniformly distributed in the ferrite grains in parts well away from pearlite areas, indicating a very rapid rate of diffusion. During slow cooling the dissolved carbide is deposited on existing crystals. The presence of dissolved C has a distinct hardening effect. Thus the sample of basic steel untreated showed a Brinell no. of 89, while heated to 680°, quenched and reheated to 550° the Brinell no. was 91 and quenched from 680° it was 105. Also in *Engineering* 124, 472-3 (1927). H. STOERTZ

Thermal expansion of cast iron. E. MORGAN. *Bull. Brit. Cast Iron Research Assn.* No. 17, 6-7 (1927). — A discussion of the observed differences (and their causes) between the theoretical expansion of cast Fe and the actual expansion in typical cases. R. H. ABORN

The graphitic decomposition of cast iron. ROBERT STUMPER. *Feuerungstech.* 15, 241-5, 255-9 (1927) — After a review with 25 references, 4 cases in which cast iron was reduced to a soft mass are illustrated (with photomicrographs) and described in detail with analyses. The conditions of corrosion in the various cases were various, and S. concludes that this type of corrosion product is a normal result of intense corrosive action of the ordinary sort. ERNEST W. THIELE

Properties and heat treatments of cast iron for Diesel engines. F. B. COYLE. *Trans. Am. Soc. Steel Treating* 12, 446-65 (1927) — Data are given in curves to show the effect of variations in compn. and heat treatment on the mechanical properties of cast Fe. Further research should be directed toward compn. of cast Fe with lower C and Si than has been produced in the past. W. A. MUDGE

Mechanical and machining properties of an annealed cast iron. G. C. PRIESTER AND F. J. CURRAN. *Trans. Am. Soc. Steel Treating* 11, 741-58 (1927). — Annealing gray-cast-Fe pistons resulted in an increase in machinability, a 30-40% decrease in strength properties and hardness, an 8-10% decrease in modulus of elasticity, a slight decrease

in max. deflection under transverse loads, a 10% decrease in allowable working stresses for the same deformation and a material change in the microstructure. W. A. M.

Action of pure carbon monoxide upon iron at elevated temperatures. W. P. FISHEL AND JOHN S. WOODRILL. *Trans. Am. Soc. Steel Treating* 11, 730-40 (1927).—The reaction between CO and Fe to produce $F_{\alpha}C$ and CO_2 has been demonstrated to obey the laws of reversible reactions. W. A. MUDGE

Testing machine for repeated impact, and a preliminary investigation on the effects of repeated impact on Lowmoor iron. J. H. SMITH AND F. V. WARNOCK. *J. Iron Steel Inst.* (advance copy), No. 13, 33 pp. (1927).—The machine was designed to apply a direct stress and to avoid the loss of energy involved in deforming hammer, anvil and specimen. The machine developed consists essentially of an anvil attached to the lower end of the specimen, while a mass of known wt. is dropped from variable heights up to 8 ft., thus delivering a tensile shock to the specimen. The driving mechanism permits of the delivery of 40 blows per min. for falls up to 30 in. Lowmoor Fe was used for the specimens because of its uniformity. The batch used contained Si 0.140, P 0.136, S 0.012, Mn 0.010 and C 0.085%, the usual static tests showing 13.95 tons/sq. in. yield stress with 55.85% reduction in area and 29.06% elongation. Brinell no. was 109 along the length of bar and 121 on the cross section. A series of tests was made using 2, 4, 10 and 20 lb. tups, and varying the heights of fall for each tup. The results show a limiting range of impact energy which could be applied repeatedly without producing rupture. For a given amt. of repeatedly applied tensile shock energy, the total energy to produce rupture is const. The single shock energy therefore may be obtained either from a small mass with a large drop or a large mass with a small drop, thus proving that momentum is not an important factor. For a given mass of tup the relation between the height of fall H and the no. of shocks N required to cause rupture is given by the equation $H = AN^2$, A and x being const. After 200 blows, A and x acquire new values. The energy required to produce rupture by a single shock was detd. for various tups and was found to range between 381.5 and 430 in. lbs., the av. being 392 in. lb. Comparing this with the energy required when static means are employed the 2 are found to be approx. equal. When the shocks to produce rupture are below a certain value, the elongation is const. and 4% greater and reduction in area is const. and 3% greater than in static tests. The effect of the shape of the specimen was studied, and the results show that abrupt changes of section, such as sharp V grooves, are a source of weakness in machine parts that have to withstand repeated tensile impact. The endurance increases with the length of the specimen up to a given value, after which it remains const. Surface finish is found to have little effect. H. STOERTZ

Some effects of hydrogen on iron and their bearing on a reported transformation at 370° C. (698° F.). H. S. RAWDON, PETER HEDNERT AND W. A. TUCKER. *Trans. Am. Soc. Steel Treating* 10, 233-56 (1926).—The polymorphic transformation in ferrite at 698° F. was not confirmed; thermal analysis and thermal expansivity measurements indicate an "irregularity." Fe treated with H_2 by heating to a high temp. exhibits a greater tendency for this phenomenon than does similar Fe not subjected to H_2 . X-ray exams. offer an explanation that the heat evolution is due to recrystn. of very fine-grained metal such as might result from the reduction of FeO by H. W. A. M.

Manufacture of malleable iron. A. E. WHITE. *Trans. Am. Soc. Steel Treating* 11, 245-63 (1927).—Equil. in Fe-C alloys of the malleable cast-Fe type is reached in less than 4 hrs. at 1800° with high-Si alloys, in 275 hrs. at 1400° F. with medium-Si alloys, and longer for the low-Si alloys. Combined C for equil. condition varies from 1.20 to 1.25% at 1800° F. to 0.47 to 0.50% at 1400° F. and is only slightly affected by ordinary variations in Si. The max. cooling rate compatible with successful maintenance of equil. is 28° F. per hr. for the lower cooling range (1500-1300° F.) for 0.90% Si alloys and faster for the upper temp. range. The rate varies for a 0.82% Si alloy from 25° to 30° F. at 1700-1600° F. down to 5-8° F. for 1400-1300° F. W. A. MUDGE

Observations on the microstructure of the path of fatigue failure in a specimen of Armco iron. F. F. LUCAS. *Trans. Am. Soc. Steel Treating* 11, 531-40 (1927).—Non-metallic inclusions in Armco iron, some of which are insecurely seated in the metal are a potential source of weakness when the metal is subjected to reversed cycles of stress. The boundary between the non-metallic inclusion and the metal is the path often followed by a fatigue crack. Non-metallic inclusions act as stepping stones for the fatigue crack. Grain boundaries and Fe_3C inclusions are not sources of weakness. Reversed cycles of stress appear to produce disturbances in the structure of the metal in advance of the visible crack. Disturbances in the metal structure adjoining the path of fatigue failure seem to be highly localized to the immediate neighborhood of the crack. Slip planes, strain lines, Neumann bands or other similar markings were not found if the

strained condition of the metal immediately adjoining the crack is disregarded. Many excellent, high-magnification photomicrographs are given. W. A. MUDGE

Normality of steel. J. D. GAT. *Trans. Am. Soc. Steel Treating* 12, 376-413 (1927).—Six types of S. A. F. Steels, one Krupp steel, one contg. 0.5% Ni and one type of Cr-Ni-V steel, in duplicate, were used, and subjected to two different carburizing treatments; viz., carburization for 6 hrs. at 1725° F. followed by cooling in the furnace to 1200° F. for 3 hrs. and carburization for 6 hrs. at 1850° F. followed by furnace cooling to 1200° F. for 4 hrs. A steel will harden satisfactorily if its structure after carburizing is composed of grains of pearlite surrounded by cementitic boundaries. For hardening, the size of the grains of steel is immaterial. Resistance to uniform hardening is caused by high O₂ content forming a eutectoid alloy with the constituents of austenite. W. A. MUDGE

Progress in study of normal and abnormal steel. S. EPSTEIN AND H. S. RAWDON. *Trans. Am. Soc. Steel Treating* 12, 337-75 (1927).—Normal and abnormal steels are defined in terms of the McQuaid-Ehn test. The general condition of abnormality in steel may be considered as "grain-size abnormality" and "structural abnormality;" the first of these often exists independently of the second. Drastic quenching of both normal and abnormal steels, hardened essentially the same, showed no surface soft spots; quenching with less drastic cooling showed a greater tendency toward soft spots with the abnormal steel, regardless of the method of heating prior to quenching. Dissolved gas in any coolant tended to produce soft spots, CO₂ being most detrimental; abnormal steel was more affected by the presence of gas in the coolant than was normal steel. High-C tool steels showed the same differences when carburized as are designated by the terms normal and abnormal for carburizing steel. Abnormal tool steels showed a greater tendency toward the production of surface soft spots upon quenching than normal tool steels. Detn. of the "gas content" of the steel has given no conclusive evidence as to the real nature of abnormality. The causes of abnormality have their origin in the steel-making process and are intimately related to the deoxidation treatment. W. A. MUDGE

Steel qualities and their relation to manufacturing processes. P. GOERENS. *Z. Ver. deut. Ing.* 70, 1093-9, 1129-36, 1194-8 (1926).—To define quality, steels are classified according to chem. compn. and process of manuf. Structure, preliminary casting and heat treatment characterize the "steel condition." Steels identical in the above respects but different in properties are denoted as "steel qualities." These depend on the care taken in the choice of raw materials and in their manuf. The influence of foreign substances on the structure and properties of steel and the forms (solid soln. and compds.) in which they occur are discussed. Many of the inclusions due to these substances have thermal expansion coeffs. half the value of that of the surrounding metal, which may lead to cracks. Pearlitic, martensitic, and austenitic steels are considered from the standpoint of formations and effect of alloying elements. The principles of the removal of foreign substances in pig iron are outlined: (1) dissolving out of S with molten lime-rich slag; (2) oxidation of C, Si, Mn and P with excess of O and removal of these oxides with slag, (3) deoxidation of the FeO formed (by excess O) with Mn, Si, Al or C, and removal of the oxides as in (2); (4) crystn. (puddling process). A diagram showing the solidification processes of steel at various temps. is presented, and an explanation of the differences in weld steel and ingot steel is given. The processes of manuf. of Bessemer, Thomas, Siemens-Martin, crucible, elec. steel, and steel from composite processes are compared. The so-called "trans-crystn." of steel and its causes are briefly described and the technology of casting is discussed. The extent to which the properties of C steels may be changed by small quantities of alloying elements is illustrated by comparative expts. with C-, Si-, Mn- and Cr-steel, manufd. by the basic Siemens-Martin process and cast in ingots of 240 × 240 mm. cross-sectional area and about 600 kg. in wt. Possibilities of improvements in the processes of steel manuf. are treated. D. THURSEN

High-speed steel. F. C. A. H. LANTSBERRY. *Trans. Am. Soc. Steel Treating* 11, 711-25 (1927).—A description of the technic of various methods of producing high-speed steel in England, America and Germany, with particular reference to the process used in Sheffield, England, in the making, compn., working, hardening, tempering and theory of high-speed steel. High-speed steel is adaptable for many uses because of its four independent and different types of hardness, viz. intrinsic hardness, C hardness, red hardness and secondary hardness. W. A. MUDGE

The importance of cementite. R. G. GUTHRIE. *Trans. Am. Soc. Steel Treating* 11, 341-54 (1927).—In low-C steels, which are not to be subjected to hardening, it is desirable to have the cementite in the spheroidal condition to give greater resistance to

corrosion, greater ductility, more stability, greater adaptability to covering by electroplating and enameling, and more ease in welding. In high-C steels, to be subjected to hardening, it is desirable to have the cementite in the lamellar form to give greater ease and homogeneity of heat treatment and resultant phys. properties. W. A. MUDGE

Existence and separation of a double carbide of iron and chromium in the colloidal state, obtained from a chromium steel. M. RAFFO AND O. SAMBUCCY. *Mét. italiana* 19, 207-10(1927).—The substance obtained after treatment of a Cr steel with HNO_3 , then washing with boiling H_2O and dialyzing repeatedly in H_2O contg. 1% HNO_3 , showed the following compn.: Fe = 64.71, Cr = 18.25, C = 13.57%, the probable formula being $\text{Fe}_4\text{C}_8\text{Cr}_3\text{C}_2$. ROBERT S. POSMONTIER

Hardness testing of steel balls by magnetic methods. S. R. WILLIAMS. *Trans. Am. Soc. Steel Treating* 11, 677-90(1927).—A description of improvements in this method of testing. W. A. MUDGE

Smooth finish machining of low-carbon plain and alloy steels. J. S. VANICK AND T. H. WICKENDEN. *Trans. Am. Soc. Steel Treating* 11, 551-68(1927).—Each of 6 S. A. E. steels of the carburizing type was found to have, under incorrect operating conditions, a tendency to machine to a rough finish in final or finishing cuts. This result was due to the existence of a crit. range of "volume removal" rates within which a rough finish was obtained. Smooth finishes were easily obtained by avoiding this crit. range. W. A. MUDGE

The transformation of retained austenite into martensite by stress. KÔTARÔ HONDA AND KEIZÔ IWASÉ. *Trans. Am. Soc. Steel Treating* 11, 399-405(1927).—See C. A. 21, 3336. W. A. MUDGE

Determining the proportional limit of steel. BENGT. KJERRMAN. *Trans. Am. Soc. Steel Treating* 12, 41-5(1927).—In order to avoid error in using the Martens extensometer for detg. the proportional limit the specimen is provided with loosely jointed extensions which reduce this alignment by increasing the distance between the jaws of the machine. Calcn. of the correct proportional limit from load-deflection data is made by detg. the elongation of the specimen corresponding to one load increment of about one to two kg. per sq. mm., assuming for steel a modulus of elasticity of 28,400,000. W. A. MUDGE

Deterioration of structural steels in the synthesis of ammonia. J. S. VANICK. *Trans. Am. Soc. Steel Treating* 12, 169-94(1927).—Ten com. steels were subjected to working conditions of 932° F., 100 atm. pressure and 8.3% NH_3 on a lab. scale. C content should be low; an increase of Cr was helpful; W was useful; V gave no perceptible improvement, while 2.25% Cr stopped selective penetration and intergranular fissuring and limited the depth of penetration to a tolerable extent. NH_3 is the active corrosive; the metal acts as a porous filter and permits an NH_3 enrichment to a destructive concn. W. A. MUDGE

Effect of temperature on the mechanical and microscopic properties of steel. G. C. PRIESTER AND O. E. HARDER. *Trans. Am. Soc. Steel Treating* 12, 436-45(1927).—A comparison of the mech. and microscopic properties of a 0.16 C and a 0.29 C steel at temps. up to 1112° F. W. A. MUDGE

Viscosity of steels at high temperatures below the melting point. NIKOLAUS CZAKÓ. *Auto-Technik* 15, No. 6, 13-15; *Chem. Zentr.* 1926, 14 289-90.—Recent investigations show that the usual methods of testing such as tensile-strength detns. of heated test rods, do not give information satisfactory for judging the behavior of a steel at elevated temperatures. The works of Cournot and Sasagawa (*Rev. métallurgie* 22, 753, 925; cf. C. A. 20, 568, 731) and of Chevenard are discussed. According to their investigations, a metal under stress becomes viscous at high temps. and elongates at a rate which can be expressed by the equation: $V = 1/[10(dI/dt)]$. The expts. were carried out in a current of N. The elongation-time curves were obtained by means of an app. employing the lever principle and recording graphically on a drum driven by clockwork. Five alloys were studied: (1) soft steel (0.04% C); (2) medium soft steel (0.22% C); (3) high-speed steel (0.50% C, 14% Cr, 13.57% W); an Fe-Ni-Cr alloy (approx. 63% Ni, 14% Cr), and (5) Si-Cr steel (2.62% Si, 10.29% Cr). The viscosities and the viscosities as a function of the tensile strengths at given temps. are shown in graphical form. C. C. DAVIS

The hardness of steel as determined by its heat treatment. P. YA. SAL'DAU AND V. N. SEMENOV. *Ann. inst. anal. phys. chim.* 3, 181-210(1926).—Cr-Ni steel of martensite structure and contg. C 0.29, Ni 5.08 and Cr 1.79% has a transition point between 680° and 700°. Specimens heated to 680° and tempered in cold water, irrespective of their previous history, attain the minimum hardness, are most resistant to a

blow and can be worked in the cold. Ferrite structure appears on heating to 680°.

BASIL C. SOVENKOFF

Stresses in quenched and tempered steel. S. L. HOYT. *Trans. Am. Soc. Steel Treating* 11, 509-27 (1927).—Tensile and compressive stresses may not, at times, exactly balance each other; their tendency to equalize results in strains or dimensional changes which are superposed on those due to the vol. changes.

W. A. MUDGE

Mechanism of the tempering of steels. TOKUJIRO MATSUSHITA AND KIYOSHI NAGASAWA. *J. Iron Steel Inst.* (advance copy), No 10, 12 pp. (1927); cf. C. A. 21, 2245.—The change in elec. resistance and intensity of magnetization are detd. for a quenched C steel contg 1.02% C, 0.33% Si, 0.30% Mn, 0.015% P and 0.022% S, and it is found that during the decompn. of *martensite*, the elec. resistance decreases and the intensity of magnetization increases, both in 2 steps below 300°. It is concluded that there are 2 kinds of *martensite*, α and β , of which during heating at a normal rate, the first decomposes at 100° to 170° and the 2nd at 170° to 300°. In decomp., *martensite* yields free C rather than *cementite*, and this combines with Fe in the interval 300° to 400° to form *cementite*. This formation of *cementite* is believed to explain the 2nd contraction in the thermal expansion curve as well as the sharp increase in magnetic hardness between 300° and 400°. This is also illustrated with a W steel contg. the double carbide 4Fe₃C.WC. The authors propose the following classification of the tempered structures of quenched C steels: *martensite* + *troostite*—100° to 300°; *troostite*—300°; *troostite* + *sorbite*—300° to 400°; *sorbite* (*osmondite*)—400°; *sorbite* + granular *pearlite*—400° to 550°; granular *pearlite*—550° to A₁ point. This is only valid for a normal rate of heating.

H. STOERTZ

Fatigue strength of hard steel and their relation to tensile strength. J. M. LESSELLS. *Trans. Am. Soc. Steel Treating* 11, 413-21 (1927).—The relation between tensile strength and Brinell hardness is linear; non homogeneity of the material may give a departure from this law. The superiority of medium-C steel in gear application, when properly heat-treated, is shown over the high-C steel.

W. A. MUDGE

Behavior of mild steel under prolonged stress at 300°. W. ROSENHAIN AND D. HANSON. *J. Iron Steel Inst.* (advance copy), No 12, 6 pp. (1927); *Engineering* 124, 409-10.—The material used was mild-steel strip contg 0.106% C, 0.395% Mn and a trace of Si. Four series of specimens were prepd. with the following heat treatment: (1). Heated to 900° and slowly cooled from 720° to 650°, producing free *cementite* in the boundaries of *ferrite* crystals. (2). Normalized at 900°, giving a microstructure of *ferrite-pearlite*. (3). Cold-worked and annealed for 4 days at 650° producing *cementite* distributed as globules throughout the *ferrite*. (4). Cold-rolled—large distorted *ferrite* grains. The specimens were subjected to loads ranging from $\frac{1}{3}$ to $\frac{2}{3}$ of the normal breaking stress, for a period of 5 years and 3 months at a temp. of 300°, and after this period were examd. for Brinell hardness and microstructure, with a 1-mm ball and a load of 5 kg. In every case a considerable increase in hardness occurred, although the amt. of straining was very slight. Thus in the series of normalized specimens, which showed the greatest strain (approx. 3%) the specimen loaded to $\frac{1}{3}$ of its tensile strength showed a Brinell no. of 71 in the unstrained portion above the shoulders, and a Brinell no. of 85 in the strained portion. No failures occurred, explained probably by the hardening which took place.

H. STOERTZ

Hair cracks in steel rails. J. H. WHITELEY. *Trans. Am. Soc. Steel Treating* 12, 208-15 (1927). A comparison of the magnetization method is followed by treatment with Fe dust in kerosene, and the picric acid etching method for detg. hair cracks in steel rails.

W. A. MUDGE

Case-carburization of production steels by means of salt baths of low cyanide concentration. H. B. NORTHRUP. *Trans. Am. Soc. Steel Treating* 12, 470-8 (1927).—Carburizing tests on 1120, 2315 and 3115 S. A. E. steels at 1650° F. show that the brittleness due to nitride absorption at 1500° F. may be largely eliminated by this higher temp.

W. A. MUDGE

Wear resistance of carburized steel versus cast high-manganese steel. W. J. MERTEN. *Trans. Am. Soc. Steel Treating* 11, 233-43 (1927).—Carefully prepd. and selected, low- and medium-C case-hardened steels are more resistant to wear than 14% Mn steel in service under pressure and sliding motion, but free from shock or pounding.

W. A. MUDGE

Dilatation of iron and steel. F. STÄBLEIN. *Stahl u. Eisen* 46, 101-4; *Engineering* 121, 395 (1926); *Science Abstracts* 29A, 427.—A description of a relatively simple app. for use in steel works for the detn. of the expansion of steel up to 1000°. Curves are given showing the records obtained with the app. for electrolytic Fe where it is seen

that 2 specimens do not give identical values in accordance with previously known information that different specimens of such Fe do not behave alike at the A_3 point, and that the expansion on heating and cooling is different. The latter is ascribed to a distortion of the lattice and difference in the α to γ and γ to α changes. Curves are also shown bringing out clearly the differences in dilatation between steels contg. more or less C than eutectoid alloy. It is seen that the dilatation curve, which is simple in pure Fe, increases in complexity with increased C content. The irregularity is less marked as the C percentage increases from 0.05 to 0.12 and again from 0.22 and 0.86. In the hypereutectoid steels with 0.97, 1.09 and 1.33% of C the slope of the curve is very steep. An attempt is also made to draw the Fe-C diagram in accordance with dilatation curves.

H. G.

The influence of the rate of pull on the observed elastic limit of ingot steels. E. H. SCHULZ AND H. BUCHHOLTZ. *Mitt. Versuchsanst. deut. Luxemburg, Bergwerksg. Hutten. A.-G. Dortmunder Union* 2, 1 9; *Chem. Zentr.* 1926, II, 1181.—Breaking tests were carried out on standard test pieces of basic Siemens-Martin and Thomas steels with different C contents to det. the influence of the rate of pull on the elastic limit. From a practical point of view the observed values of the latter were considerably influenced by the rate of pull. The influence of this rate when 80-100 sec. was required to reach the elastic limit, or a rate not over 0.5 kg. per sq. mm. per sec. was insignificant, and even at a rate of pull of 0.5-1.0 kg. per sq. mm. per sec. it was still not great. Above this, however, the values of the elastic limit increased notably, the increase reaching 11% with soft steels and 9% with hard steels when the rate was 10 kg. per sq. mm. per sec. From a practical point of view the tensile strength, elongation and contraction were not materially influenced by the rate of pull.

C. C. DAVIS

Investigation of bolt steels. V. T. MALCOLM AND JOHN JUPPENLATZ. *Trans. Am. Soc. Steel Treating* 11, 177-216(1927).—A heat-treated alloy steel bolt has been recommended to supplement the C steel bolt in order to meet the higher pressure and temp. demands in power plant and oil refineries. Selection of raw material, method of manuf. and rigid inspection are equally essential with heat treatment, phys. tests and chem. analyses. All advantages claimed for case-hardened nuts may be had without the bad effects by substituting a medium-C, heat-treated steel nut. Detailed tests and their results are given.

W. A. MUDGE

Cutting power of high-speed steel tools and methods of testing. F. RAPATZ. *Stahl u. Eisen* 49, 1109-16(1926).—The cutting power of W steels increases with the hardening temp. slowly between 1000° and 1170° and then rapidly to a max. at about 1300°. The best cutting properties are obtained when the microstructure consists entirely of evenly oriented, fairly large polyhedral grains contg. regularly distributed, small inclusions of the ledeburite eutectic, i. e., when the max. amt. of carbide possible is retained in solid soln. With plain 14-18% W steels this structure is obtained by heating for 10 min. at 1250° or for 1-3 min. at 1300°. The longer period of heating at 1250°, although it gives slightly the more satisfactory structure, has the disadvantage that it is difficult to prevent serious oxidation taking place; on the other hand, care must be taken not to exceed 3 min. at 1300° or to allow the temp. to rise more than 20° above this temp., the metal will be ruined by fusion and redistribution of the eutectic accompanied by abnormal growth of the polyhedral grains. Alloys contg. Co or V in addn. to W may safely be heated to a higher temp. as these elements appear to raise the m. p. of the eutectic. All high-speed tool steels are rendered harder and tougher by subsequent tempering at 580°, whereby the austenite is converted into martensite and internal strains are relieved. As the tensile strength of the alloy increases its life as a cutting tool is reduced very rapidly; an increase in the speed of cutting also reduces the life of the tool but the reduction is not proportional to the cutting speed. The compn. of a steel is no indication of its behavior as a cutting tool; the controlling factors in detg. the life of a tool are hardness combined with toughness and suitable microstructure, as well as homogeneity and freedom from slag inclusions.

B. C. A.

Comparative tests on ball-bearing steels. T. L. ROBINSON. *Trans. Am. Soc. Steel Treating* 11, 607-18(1927).—The size and distribution of the particles of excess cementite are factors in the performance of steel both under reverse stress or fatigue tests and under the static bending test. Steels in which these particles of cementite are comparatively small and uniformly distributed show greater endurance and strength.

W. A. MUDGE

Crystallization and structure of metals and alloys. ALBERT PORTEVIN. *Bull. soc. chim.* [4], 41, 961-87(1927).—An address dealing with structure of solidification which exerts a "hereditary" effect on all subsequent states, effect of mech. deformations

in the cold, effects of reheating or annealing after deformation, and effects of polymorphic transformations as exemplified in Fe and mild steels. A. PAPINEAU-COUTURE

"Tula" alloys. The ternary system cuprous sulfide, silver sulfide, lead sulfide. ROBERT SCHWARZ AND ALFONSO ROMERO. *Z. anorg. allgem. Chem.* **162**, 149-60(1927).—Cu, Ag, Pb and S alloys used for ornamental purposes and known under the name of "tula" or "myello" show on analysis that all the S is combined, a typical alloy contg. 12% Ag_2S , 52% Cu_2S and 36% PbS . The binary systems $\text{Ag}_2\text{S}-\text{Cu}_2\text{S}$, $\text{PbS}-\text{Cu}_2\text{S}$, $\text{Ag}_2\text{S}-\text{PbS}$ were examd. $\text{Cu}_2\text{S}-\text{Ag}_2\text{S}$ shows an unbroken series of mixed crystals with a min. at 665° contg. about 70% Ag_2S . The system $\text{Ag}_2\text{S}-\text{PbS}$ possesses a eutectic with the compn. 77% Ag_2S at 630°. The system $\text{Cu}_2\text{S}-\text{PbS}$ has a eutectic at 540° contg. 51% Cu_2S . The ternary system is studied and the space diagram $\text{Ag}_2\text{S}-\text{PbS}-\text{Cu}_2\text{S}$ is detd. The cooling curve shows the existence of 2 primary crystn. planes, the one characterized by the primary sepn. of mixed crystals and the secondary sepn. of PbS , and the other by the primary sepn. of PbS and the secondary sepn. of mixed crystals. The line connecting the eutectic points $\text{Cu}_2\text{S}-\text{PbS}$ and $\text{PbS}-\text{Ag}_2\text{S}$ is carefully investigated. The space diagram as detd. agrees very well with that theoretically required. H. STOERTZ

The changes of silver-zinc alloys in the crystalline condition. G. I. PUTRENKO. *Z. anorg. allgem. Chem.* **165**, 297-304(1927); cf. *C. A.* **20**, 1023.—Thermal and microscopic analyses of Ag-Zn alloys show the existence of the following compds: Ag_2Zn , Ag_2Zn_3 , Ag_2Zn_6 . Ag_2Zn is found to be dimorphous, with a transition point at 254°

F. A. JENKINS

The iron molybdenum system. W. P. SYKES. *Trans. Am. Soc. Steel Treating* **10**, 839-69(1926).—A description of the C free alloys of Fe and Mo including the equl diagram as detd. from fusion temps., heat treatments and a study of microstructures. Notable features include a eutectic at 36% Mo m. 2625° F., a glass-hard, intermetallic compd., Fe_3Mo_2 , at 53.4% Mo, and appreciable solid soly. increasing with rise in temp. at either end of the system. Secondary hardness may be developed by aging a super satd. soln. at 1112-1292° F.; this hardness is equal to that of high-speed steel and persists at temps. considerably higher. A_r is lowered from 2550° to 2245° F. and A_r is raised to 1795° F. by the addn. of 3% Mo to pure Fe. With a Mo content greater than 3.5-4% the Fe exists in the body-centered crystal lattice at all temps. below the m. p.

W. A. MUDGE

Graphitizing behavior of iron carbide in pure iron-carbon alloys in the critical-range. H. P. EVANS AND ANSON HAYES. *Trans. Am. Soc. Steel Treating* **11**, 691-707(1927).—Fe-C alloys of high purity have been graphitized in the presence of a $\text{CO}-\text{CO}_2$ gas mixt. at a pressure of 5 atm. within the temp. interval 1292-1875° F. Fe₃C in Fe-C alloys of high purity and contg. about 2.3% C is metastable at temps. below 1292° F. and above 1562° F. in the presence of this $\text{CO}-\text{CO}_2$ gas mixt. when it is applied at a pressure of 5 atm.

W. A. MUDGE

Heat of formation of cementite as electrolyzed from a pure iron-carbon alloy of eutectoid structure and composition. G. H. BRODIE, W. H. JENNINGS AND ANSON HAYES. *Trans. Am. Soc. Steel Treating* **10**, 615-29(1926).—A value of -13580 cal per g. mol. was obtained at 86° F. by a calorimetric detn. of the heat of formation of Fe₃C.

W. A. MUDGE

Iron-carbon-vanadium alloy for Brinell balls. G. W. QUICK AND L. JORDAN. *Trans. Am. Soc. Steel Treating* **12**, 3-24(1927).—Work-hardened Fe-C-V steel balls have been produced more resistant to permanent deformation than Hultgren balls. For testing materials of 800 Brinell or over these balls should be superior to the Hultgren ball but offer no advantage over the Hultgren ball for testing materials up to 700 Brinell

W. A. MUDGE

The diagram of state of iron-nickel alloys. S. A. POGODIN. *Ann. inst. anal. phys. chim.* **3**, 477-8(1926).—The diagram of hardness exhibits breaks between 10 and 25% Ni. solid solns. being formed on either side. The sp. resistance and cond. curves are also continuous between 30 and 100% Ni. Meteoric Fe is an equil. mixt., whereas artificial alloys are metastable.

BASIL C. SOYINKOFF

Heterogeneity of iron-manganese alloys. C. R. WOHRMAN. *Am. Inst. Mining Met. Eng., Technical Publication No. 14*, 32 pp (1927).—The photomicrographic structures of Fe-Mn alloys contg. approx. 30% Mn (Mn-1), 8% Mn (Mn-2) and 3% Mn (Mn-3), are interpreted, the Widmanstätten and martensitic patterns being regarded as structures resulting from the breaking up of a solid phase into 2 phases, and proof therefore of the heterogeneity of the alloys. The martensitic structure differs from the Widmanstätten merely in being considerably finer, less well defined and less regular. The examn. included a detn. of the structural changes produced by heat treatment, quenching and annealing, and the value of high magnifications is emphasized. Sys-

tems of definite constituents, stable within definite temp. and concn. regions, are found. Thus on thorough annealing, an aggregate is formed consisting of a ferritic constituent, probably a solid soln. of a small quantity of Mn in α -Fe, and a cementitic constituent which must be a Mn-rich intermetallic compd. It is further suggested that there exists a eutectoid of the 2 contg. about 6% Mn. This appears first in the segregate form of *martensite*, consisting of phases which break down into "*Mn-cementite*" and "*Mn-ferrite*," the aggregate retaining at first the martensitic or Widmanstätten pattern, but changing, on continued annealing, to the lamellar form of *pearlite*. These structures are strikingly similar to those of Fe-C alloys, and W. concludes that the valuable properties of steels are vested in the solid solns. which Fe tends to form, the influence of C being overemphasized in the past. He objects to the term "austenitic" as applied to a group of steels contg. little, if any, *austenite* proper, unless austenite be redefined as a solid soln. of any element in γ -Fe. H. STOERTZ

The miscibility gap in liquid iron-copper alloys. ANTON MÜLLER. *Z. anorg. allgem. Chem.* **162**, 231-6(1927); cf. *C. A.* **21**, 2245.—When Fe-Cu alloy in which sepn. into 2 layers had occurred is heated below the crit. point (1520°), the alloy becomes homogeneous. The miscibility gap is only slightly influenced by C up to about 0.2%, but an alloy contg. 0.31% C could not be homogenized even by heating as low as 1460°. H. STOERTZ

Study of type metals and of lead-tin alloys. A. TRAVERS AND HOUOT. *Rev. metal.* **24**, 541-54(1927).—The Chevenard differential dilatometer was used in the systematic investigation of the hardening of ternary Pb-Sn-Sb alloys and of binary Pb-Sn alloys, particularly for the study of tempering at const. temp. accompanied by contraction. The method allows of detecting traces of hardening, and more particularly of studying the effects of a few 0.1% Pb on Sn or Sn on Pb. The hardening of ternary alloys such as type metals increases with the Sn content, temp. of casting and rate of cooling. Sb does not seem to have any effect. Hardening can also take place, starting from the solid metal at a temp. of 180° or over. These alloys can undergo tempering even at atm. temp.; at the end of 7 months an alloy which had been cast in a chill mold had undergone approx. 67% of the contraction which occurred after complete annealing. Dilatometric study of Pb-Sn alloys showed that, with 0-1% Sn, Pb which had been cast in chill molds showed signs of hardening; but after annealing at about 200° it could not be hardened from the solid state. On the contrary, Sn contg. a few 0.1% Pb can be hardened from the solid state. The degree of hardening of Pb-Sn alloys increases with the Sn content to a max. at 16%. The dilatometric curves obtained on cooling pure Pb showed 1 or 2 breaks indicating allotropic modifications. In studying the transformation rhombohedral Sn \rightleftharpoons quadratic Sn, the calorimetric curves exhibited a discontinuity (break or flattening) at about 171-2° when the molten Sn had been overheated several hrs. at or above 500°. No satisfactory explanation of this anomaly has yet been found, but it may be related in some way to the allotropic transformation of Sn. Methods of analysis of type metals are outlined. A. P.-C.

A comparison of the alloying elements chromium, nickel, molybdenum and vanadium in structural steels. H. J. FRENCH. *Trans. Am. Soc. Steel Treating* **11**, 845-88(1927).—A condensed summary of important characteristics of alloy steels contg. Cr, Ni, Mo and V, illustrated by many practical applications. No one of the four alloying elements has a monopoly on all of the desirable properties of steel for structural purposes. At least three of the elements, viz., Cr, Ni and Mo, and possibly all four, will play an important part in future structural development. W. A. MUDGE

An x-ray study of the β transformation in copper-zinc alloys. ARTHUR PHILLIPS AND L. W. THELIN. *J. Franklin Inst.* **204**, 359-68(1927).—Spectrograms from β brass (51.1% Cu) held at 520° give no indication of a new lattice as compared with the same material at room temp. The 470° transformation is therefore not due to a crystal phase change but may be the result of sub-atomic energy changes. β brass has a body-centered cubic lattice (confirming previous work by Owen and Preston, and Westgren and Phragmen). The parameter increases from 2.956 A. U. to 2.974 A. U. as the % Zn increases from 48.9 to 49.6%. At 520° the parameter is 3.007 A. U. R. H. A.

Useful aluminum alloys. Replacement of silicon by germanium. W. KROLL. *Metall u. Erz* **23**, 684-5(1926).—Ten new Al alloys were prepd. and tested having known quantities of Ge, Si, Mg, Cu and Fe. Addn. of small quantities (1.2-1.6%) of Ge to duralumin, "lantal" and "aludur" alloys increased their strength by 1 kg./sq. mm. and improved the rolling properties of duralumin. Mg germanides are formed. C. G. K.

Useful aluminum alloys. Replacement of silicon with beryllium. W. KROLL. *Metall u. Erz* **23**, 613-6(1926).—Al-Be and Al-Be-Mg alloys have valuable properties which are given for 23 new alloys having a known content of Al, Cu, Mg, Be, Si and Fe.

Each plays an important role in the formation of eutectics at different temps. A Mg beryllide is thought to be formed, whose soly. in Al increases at higher temp. and with addn. of Mg. Addn. of Be causes slight hardening in the "lantal" group, little effect upon duralumin, but has a marked effect upon the "aludur" type. Be replaces Si only insofar as it forms compds. with Mg which are sol. in Al. C. G. KING

The diagram germanium-aluminum. W. KROLL. *Metall u. Erz* 23, 682-4(1926).—Eleven alloys were prepd. having 0.92 to 60.0% Ge in Al with 0.25% Si and 0.45% Fe. The eutectic point is 423°, with an alloy contg. 55% Ge. With low % Ge, sepn. began at 656°. Ge forms a compd. with Mg, and produces a greater hardness (40% Ge gave 82 Brinell) than Si. C. G. KING

The mechanical characteristics of binary aluminum-beryllium alloys. W. KROLL. *Metall u. Erz* 23, 616 8(1926).—Addn. of Be to Al increases its strength giving optimum qualities at about 6%. The effects of Be and Si are similar, but Si produces a greater effect per unit wt. C. G. KING

The under-cooling of some aluminum alloys. MARIE I. V. GAYLER. *J. Inst. Metals* (advance copy), No. 442, 28 pp.(1927).—Some Al-Si alloys contg. up to 20% Si were fused and cooled very rapidly, while time-temp. curves were plotted. The super-soly. curve for the system was plotted from these results. The mechanism of crystn. is discussed, and typical microstructures are shown. The macrostructure was coarser when Al crystd. first. Similar expts. were carried out with alloys modified by Na, in which systematic under-cooling did not occur, and showed that the equil. diagram of the modified alloys agreed closely with the super-soly. curve of the normal alloys. The addn. of Na caused crystn. to take place at temps. on the super-soly. curves. The modifier probably increases the no. of nuclei at the moment of crystn. Alloys contg. about 10.4% Si and up to 0.8% Fe; those with 0.14% Fe and up to 38% Cu; and those with 7.2% Cu and up to 0.7% Fe were also studied, and the effects of undercooling on the structures are illustrated. Casting high-purity Al-Si alloys in chills did not give truly modified structures. Expts. with an Al alloy contg. 7% Cu showed that with higher casting temp. the macrostructure was coarser, but the microstructure finer due to undercooling. GEO. F. COMSTOCK

Copper-magnesium alloys. II. W. T. COOK AND W. R. D. JONES. *J. Inst. Metals* (advance copy), No. 434, 22 pp.; cf. C. A. 20, 3421.—The properties of Cu-Mg alloys contg. 0-11% Cu in the forged and heat-treated conditions were detd. The ductility depends primarily on the forging temp. The latter should not be lower than 350°. Simple heat-treatment causes a decrease in test values. Addn. of Cu to Mg is beneficial up to about 2% Cu. Beyond this quantity the ductility decreases while the sp. gr. increases. For good results control of forging temp. is essential. Care must be taken to avoid cold-shuts by using preheated molds. H. S. v. K.

Magnetism and crystal structure in manganese-aluminum-copper alloys. FR. HEUSLER. *Z. anorg. allgem. Chem.* 161, 159-60(1927).—The alloy consisting of approx. 14% Mn, 10% Al and 76% Cu is non-magnetic when quenched from red heat. If aged at 80° it becomes weakly magnetic with almost no hysteresis. This occurs without any apparent alteration in structure. By appropriate treatment below 260° a third state is produced, characterized by mechanical and magnetic hardness. This is accompanied by a deep-seated alteration in the crystal structure and by a decrease in the elec. resistance. H. suggests the following explanation: At red heat sometimes the Al atoms, at other times the Cu and Mn atoms, are completely dissoed. This state is preserved by quenching. Aging at 80° brings about a chem. binding of the Mn and Cu atoms to the Al atoms, without alteration in crystal structure. This chemical union accounts for the inception of the ferromagnetic properties. W. W. STIFLER

Heat treatment of aluminum-silicon alloys. R. S. ARCHER, L. W. KEMPF AND D. B. HOBBS. *Am. Inst. Mining Met. Eng., Tech. Publications* No. 23, 30 pp.(1927).—Details are given of an extensive research on the effect of heat treatment on Al-Si alloys. Tables, phase diagrams, photomicrographs of structure and graphs showing the effect of the heat treatment on phys. properties accompany the papers. Quenching from 565° as compared with slow cooling produces increased hardening and a decrease in plasticity and elongation. Aging at room temp. has little effect on the phys. properties of these alloys, but aging at elevated temps. increases the hardness up to 20%. Spheroidizing and growth of the Si particles are very marked at temps. above 565° and accompanied by decreased hardness and strength, increased plasticity and usually increased ductility. These effects increase with the temp. and time of heat treatment. In general the strength and hardness of castings are increased by short, and reduced by long heat treatments. J. W. SHIPLEY

Commercial forms and applications of aluminum and aluminum alloys. P. V.

FARAGHER. *Am. Inst. Mining Met. Eng., Tech. Publication No. 33*, 28 pp.(1927); cf. preceding abstr.—F. presents the com. side of the Al industry in the U. S. The use of the various alloys of Al in the manuf. of motors, aircraft, engine bases, railway cars and automobile bodies is described and the com. forms and sizes of each alloy are given, together with the phys. and mech. properties. No metallurgical considerations are included. **J. W. SHIPLEY**

Equilibrium relations in aluminum-silicon and aluminum-iron-silicon alloys of high purity. E. H. DIX, JR., AND A. C. HEATH, JR. *Am. Inst. Mining Met. Eng., Tech. Publication No. 30*, 31 pp.(1927).—The object of the investigation was to det. the solid soly. of Si in Al, to establish the position of the solidus at the Al end and to check the eutectic temp. and concn. Al of 99.951% and Si of 98.64% purity were used. Alloys for soly. work contained a max. of 0.05% Fe. Cooling curves were obtained for the alloys and the position of the eutectic was checked by quenching and microscopical examn. Temps. were detd. by a Pt Pt-Rh couple. A uniform eutectic structure formed over small areas only. Analysis of such areas showed a Si content of 11.82% as compared with 11.6% found by Edwards and 11.7% by Gwyer and Phillips. Soly. detns. were made on specimens homogenized by annealing at temps. 15° to 20° under the eutectic temp. for a week. Solidus detns. were made in a Hoskins furnace controlled by a Leeds and Northrup controller-recorder. All specimens were annealed for 120 hrs. at 560° and then quenched. Temp. readings were taken at 5-min. intervals. Photomicrographs were used for comparing and identifying the cryst. structures. The results are plotted on an equil. diagram. Al-Fe-Si alloys were prepd. contg. as high as 40.78% Fe and 28.87% Si. Annealing periods varied from 1 to 5 weeks. Porosity and cracks were characteristic of alloys high in Fe and low in Si. Examn. of alloys prepd. at the intersection of Al-FeSi₂ and of FeAl₃-Si on the phase diagram indicated that the line Al-FeSi₂ and FeAl₃-Si does not exist. An alloy corresponding to the formula FeAl₃ was prepd. and detd. to be completely homogeneous, thus proving the existence of this compd. The authors suggest that the "X" constituent of com. Al be designated α (Fe-Si) and the second alloy of Al-Fe-Si as β (Fe-Si). The first occurs in "Chinese script" crystals while the latter is found as curved needles. Triangular phase-field diagrams are given. **J. W. SHIPLEY**

Some aspects of the commercial manipulation of aluminum. C. F. NAGEL, JR. *Am. Inst. Mining Met. Eng., Tech. Publication No. 32*, 21 pp.(1927).—The properties of duralumin and other com. alloys of Al are given by N. together with a detailed description of the various heat treatments to which the alloys are subjected in the prepn. of com. metal. The manipulation in hot forming, jointing, soldering and riveting Al and duralumin is described, and the art of welding these metals treated in considerable detail. Tables, drawings and photographs are given. **J. W. SHIPLEY**

Physical characteristics of commercial copper-zinc alloys. W. H. BASSETT AND C. H. DAVIS. *Am. Inst. Mining Met. Eng., Tech. Publication No. 26*, 16 pp.(1927).—Tests on Cu-Zn alloys, including tensile, alternate bending and hardness, are given together with photomicrographs of the effect of annealing on the structure and grain size of Cu-Zn alloys between 100 and 39% Cu. A 65-67% Cu brass draws more deeply when strongly annealed (750°) but, because of the large size of the grains, presents a rough surface. A lighter anneal (600-650°) gave almost as deep a draw and a much smoother surface, while annealing at 425-550° gave much smaller grains and a smooth surface easily polished. Impurities such as Fe lower the size of grains and increase the hardness. The heat treatment previous to rolling very markedly affects the phys. properties of the sheet metal. High annealing temps. produce a lowering of the tensile strength of the rolled metal. Satisfactory specifications for Cu-Zn alloys should be based on the use to which the sheet metal is intended, and each alloy should have its own set of phys.-test data from which a specification may be prepd. **J. W. S.**

Polishing and etching lead, tin, and some of their alloys for microscopic examination. J. R. VILELLA AND D. BRERGEKOFF. *Ind. Eng. Chem.* 19, 1049-52(1927).—In polishing soft metals for microscopic examn. it is more important to avoid distortion of the structure than scratches on the surface. A suitable method is described, involving the use of emery papers coated with paraffin. Alternate etching and repolishing are necessary to show the true structure clearly: Mixts. of HNO₃, acetic acid, and glycerol were used for etching, the methods being described in detail. Excellent photomicrographs are shown. **GEO. F. COMSTOCK**

The effect of boiling orange juice on various alloys and metals. A. L. BLOUNT AND H. S. BAILEY. *Trans. Am. Inst. Chem. Eng.* 18, 139-48(1926).—Corrosion tests, made in boiling orange juice on various metals, classified 2 groups as follows: (1) metals of low corrosion rate (below 0.0001 in. per month). Duraloy brass, Alcumite, Mond

70, Everdur, Monel, listed in order of decreasing resistance; (2) other metals tested including Cu and Al alloys (corrosion rate greater than 0.0006 in. per mo.) The thermal conductivities enter into the selection of materials as well as other factors. A complete discussion of several alloys is given. J. K. ROBERTS

A study of some of the causes of failure in heat-resisting alloys. ROGER SUTTON. *Trans. Am. Soc. Steel Treating* 12, 221-34 (1927).—Ni-Cr carburizing boxes contg. 60% Ni, 18% Cr and 15% Fe were found to give best service life at high temp. when the Fe₃C was evenly distributed and in a thoroughly globular condition, thus denoting a slow cooling rate in the original casting. W. A. MUDGE

Age-hardening tests with electron alloys. K. L. MEISSNER. *J. Inst. Metals* (advance copy), No. 436, 18 pp. (1927).—Six Mg alloys contg. up to 10.6% Al and up to 4% Zn were tested in the form of sheet or extruded rod, for Brinell hardness after heating, quenching, and aging. Some tensile and elongation tests also are reported. Age-hardening is possible with these alloys because Al and Zn form solid solns. with Mg and the soly. decreases with falling temp. The amts. of age-hardening of the 6 alloys at various temps. and for various periods of time are tabulated and plotted. From these results, it is concluded that between 5.5 and 6% Al must be sol. in solid Mg. The age-hardening with Al is greater than that with Zn, but none occurs unless the amt. of the compds. present is greater than is sol. in Mg at room temp. For appreciable hardening, the aging must be carried out above room temp. GEO. P. COMSTOCK

Aluminum bronze. JEROME STRAUSS. *Trans. Am. Soc. Steel Treating* 12, 69-105, 239 73 (1927).—A review of the constitution, mechanical properties and resistance to corrosion of Al-Cu alloys, with and without the addition of other elements. An effort is made to cover the entire useful range of these alloys with particular stress upon the properties and practice common to those compns. of widest commercial use. W. A. MUDGE

Foreword to symposium on corrosion. P. D. MERICA. *Trans. Am. Inst. Chem. Eng.* 18, 1-6 (1926).—A review of problems of corrosion and progress made in the theory and practical preventive methods J. K. ROBERTS

Contribution to the theory of processes of corrosion. ROBERT STUMPER. *Korrosion u. Metallschutz* 3, 169-71 (1927).—The process of corrosion is considered to take place thus: (1) Formation of Fe⁺⁺ ion followed by evolution of H₂ and formation of Fe(OH)₂; (2) the oxidation of Fe(OH)₂ to Fe(OH)₃; and (3) conversion to hydrated ferrous and ferric oxides $x\text{FeO} \cdot y\text{Fe}_2\text{O}_3 \cdot z\text{H}_2\text{O}$ with the liberation of water. This liberation of water causes the formation of a loose and porous rust which film does not prevent the continuance of corrosion. J. K. ROBERTS

Paradox of corrosion and protective film theory. T. FUJIHARA. *Ind. Eng. Chem.* 19, 1008 9 (1927).—From microscopic observations of the progress of corrosion it is concluded that protective films are formed by corrosion products and that the more favorable the conditions are for corrosion the less the corrosion. J. K. ROBERTS

Corrosion of copper pipes. A. F. DUFTON AND F. L. BRADY. *Nature* 120, 367 (1927).—Corrosion in water pipes of Cu lined with Sn is due to tarnishing of the Sn. This can be shown by the potential between Cu-Sn and Cu-tarnished Sn. R. H. L.

Corrosive effect of nitric acid, mixed acid, and sulfuric acid on some of the new alloys with special reference to stainless steels. F. F. CHAPMAN. *Trans. Am. Inst. Chem. Eng.* 18, 7-18 (1926).—A series of tests made on stainless steels and irons in HNO₃, free from Cl₂, HCl and H₂SO₄ indicated that nearly all such steels resisted corrosion in all strengths of acid at all temps. up to the b. p. These results have been well brought out in service. Welded joints cause most of the trouble. Chrome steels made by different manufacturers can safely be joined together in service without electrolytic action. Traces of HCl in HNO₃ have little effect. In practice HCl in HNO₃ causes very rapid corrosion, especially in intermittent deliveries. Cr steels resist mixed acids efficiently. Data on corrosion rates in various acid mixts. are given. J. K. ROBERTS

Corrosive effect of nitric, hydrochloric and sulfuric acids on pure lead and lead containing small amounts of copper and antimony. J. C. OLSEN M. H. QUELL AND WM. G. HOLLEV. *Trans. Am. Inst. Chem. Eng.* 18, 19-36 (1926).—Tests were run on pure Pb and Pb contg. Sb and Cu in various acids in motion and at rest at temps. of 20° to 100°. Corrosion in H₂SO₄ increases with the temp. and concn., and is least on Pb contg. 0.1% Cu. In HCl the greatest corrosion was on Pb contg. Sb and least on pure Pb. Pure Pb is least affected by HNO₃, and corrosion is least in the concd. acid. Conclusion: The presence of Sb increases corrosion especially in HCl, while Cu has a protective action in H₂SO₄, but an accelerating action in other acids. J. K. R.

Heat treating of mists. E. VALD ANDERSON. *Trans. Am. Inst. Chem. Eng.* 18, 9 (1926).—Sepn. of mists causes corrosion difficulties. As long as gases

are above the dew point of acid gases little corrosion is experienced; thus heat insulation is often a good preventive measure. In general the corrosive action of mists and fumes is the same as resultant solns. Materials of construction are discussed. J. K. R.

Protection of aluminum and its alloys against corrosion. H. SUTTON AND A. J. SIDERY. *J. Inst. Metals* (advance copy), No. 439, 17 pp.; *Engineering* 124, 376-7(1927).—Expts. are described in which samples of Al and Al alloys used in airplanes are protected against corrosion (1) by anodic oxidation and (2) by electrodeposited coatings of Zn, Cd and Ni. The corrosion periods were extended to periods of 1 to 2 years. The resistance to corrosion by sea-water is considerably increased by anodic oxidation followed by the application of lanolin, in the form of a 15% soln. in benzene. Electrodeposited Zn coatings 0.0005 in. thick gave better protection to Al than did similar coatings of Cd but the degree of protection was about the same for both on Al alloys. Deposits of Ni of normal thickness were unsatisfactory. A comparison is made between the two methods of treatment. H. S. VAN KLOOSTER

Corrosion at riveted joints. U. R. EVANS. *Engineering* 124, 179-80(1927); cf. C. A. 21, 2114.—A further discussion of how corrosion proceeds in boilers, especially in riveted joints. J. K. ROBERTS

Corrosion in the laundry industry. J. N. VERMILYA. *Trans. Am. Inst. Chem. Eng.* 18, 95-107(1926).—The importance of non-corrodible metals for use in wash wheels, etc., in laundries is stressed, and a discussion of laundry processes and their effect on corrosion are discussed. At present 25% Ni casting alloy has been adopted and appears to resist corrosion. J. K. ROBERTS

Properties of boiler tubing at elevated temperatures determined by expansion tests. A. E. WHITE AND C. L. CLARK. *Mech. Eng.* 49, 1093-7(1927).—A preliminary communication of results obtained from measurements of safe working loads for 0.13% C steel seamless tubing at high temps. Closed tubes were heated in a resistance furnace to 1000°, 1250° and 1500°F. Pressure was applied to the interior of the tubes by N from a tank. At the temps. mentioned the authors find that the proportional limit, as ordinarily detd. by short-time tests, cannot be used as a criterion in judging the stability of the metal. Test pieces, run at loads well below the short-time proportional-limit, showed decided expansion on prolonged heating. It is recommended that an adequate factor of safety be applied whenever short-time proportional-limit values for elevated temps. are employed in engineering design. An excellent discussion of the paper shows how the authors may have made considerable error in their measurements, first, due to the test tubes not being exactly concentric, and second, due to the inadequate means employed to measure the outside diam. of the heated tubes. W. F. E.

Studies on electric welding. L. J. WEBER. *Trans. Am. Soc. Steel Treating* 11, 125-40(1927).—Abnormal carburizing steels are produced in steels deposited by means of the elec. arc in atms. of CO, CO₂, N₂ and air. Normal carburizing steel was obtained if the metal was deposited in a pure inert gas such as He. The elec. arc decomposes CO₂ into CO and O; CO is decompd. with the formation of CO₂. W. A. M.

The application of Röntgen rays in the welding technic. C. KANTNER AND A. HERR. *Z. Ver. deut. Ing.* 71, 571-6(1927).—The detection of defects with the aid of Röntgen rays in welded and unwelded materials is described. It is shown that this may safely be accomplished and offers advantages over the usual phys., chem. and metallographical investigation methods, viz., (1) an extended area of the material may be investigated; (2) testing may be carried out without cutting or destruction of the metal piece and (3) in particular weldings may be investigated rapidly and in an improved manner. The method depends on the permeability of the materials by hard rays of short wave length. An app. for this purpose is illustrated and described. A series of samples of the usual metallic work materials was prepd. and investigated röntgenographically and, to confirm the results, also metallographically. The Röntgen photographs of welds gave important data as to the judgment in their prepn. and use. Leaks, gas bubbles and hollow spaces in the welds were indicated by bright, sharply defined spots. Foreign matter, slag, etc., appeared as agglomerations, bud-like formations, bands or lines. Burned areas in the welds (formation of oxidation products) appeared as irregular bright spots. Poor welds were clearly marked, but showed the same brightness as the material itself, while good welds appeared cloudy in the transition zone. Cracks by contraction, due to unequal cooling stresses, appeared as very bright, sharply defined lines. A series of photographs of the various conditions is given. D. THUSEN

The utilization of cob char as a carburizing agent. H. L. MAXWELL. *Proc. Iowa Acad. Sci.* 33, 174(1926).—It is shown that the char resulting from the distn. of corn cobs in the manuf. of furfural, may be substituted for the more expensive bone char now being used in the carburizing process. The distribution of the tri-ferro car-

bide, Fe_3C , in the carburized zone may be closely governed by time and temp. variations. W. G. GAESSLER

The combustibility and the strength of metallurgical coke with a coarse grain (HÄUSSER BESTEHORN) 21. The analysis of silicate slags (COLCLOUGH) 7. Study of spectrography, crystallography and metallography with the use of x-rays (ROLLA, MAZZA) 3. Equilibria in the reduction, oxidation and carburization of Fe. II. CH_4/H_2 equilibria in the presence of Co (SCHENCK, *et al.*) 2. Magnesia refractories for steel furnaces (CARRIE, PASCOE) 19. The passivity of iron mirrors (FREUNDLICH, *et al.*) 2. A new method for the evaporation of electrolytic caustic (BADGER) 18. The ternary system Ag-Sn-Cu (GUERTLER, BONSACK) 2. A by-product producer gas plant at a copper works (ANON.) 21.

BARLIK, HEINZ: *La galvanisation du fer*. Translated from German into French by A. Schubert. Paris: Dunod. 220 pp.; 58.80 francs (bound); 49 francs (paper). Reviewed in *Bull. soc. ind. Mulhouse* 93, 447 (1927); *Rev. métal.* 24, 555 (1927).

ROUX-BRAHIC, J.: *Traitement métallurgique des minerais complexes*. Paris: Dunod. 784 pp. Reviewed in *Rev. métal.* 24, 555 (1927).

COTEL: *Der Siemens Martin Ofen*. Leipzig: Otto Spamer. 150 pp.; 20 R. M. Reviewed in *Rev. métal.* 24, 556 (1927).

GUERTLER: *Metallographie: Die thermische Ausdehnung*. Berlin: Gebrüder Borntraeger. 336 pp.; 18.80 R. M. Reviewed in *Rev. métal.* 24, 556 (1927).

MOORE, H. F.: *Manual of the Endurance of Metals under Repeated Stress*. New York City: Engineering Foundation. 63 pp. \$1. Reviewed in *Eng. News-Rec.* 99, 112 (1927).

MÜLLER-HAUFF, A., AND STEIN: *Autostaehle des Welthandels*. Dusseldorf: Verlag Stahl Eisen. 224 pp.; 9 R. M. Reviewed in *Rev. métal.* 24, 556 (1927).

REJTOE: *Einige Prinzipien der theoretischen mechanischen Technologie der Metalle*. Berlin: Rejtoe. Reviewed in *Rev. métal.* 24, 556 (1927).

VANDEBLU, H. B., AND CRUM, W. L.: *The Iron Industry in Prosperity and Depression*. Chicago, Ill.: A. W. Shaw Co. \$7.50. Reviewed in *Can. Chem. Met.* 11, 48 (1927).

Ore processing. F. DIETZSCH. Can. 273,581, Sept. 6, 1927. Oxidized or roasted Cu ores are treated with a compd. soln. contg. H_2SO_4 , dissolved in a substantially satd. soln. of alkali chloride, alk. earth chloride or other suitable metallic chloride, so as to obtain a soln. charged with a complex cuprous salt. The excess H_2SO_4 is expelled and the Cu pptd. by bringing the soln. into contact with Fe.

Ore processing. P. C. SCHRAPS. Can. 274,713, Oct. 18, 1927. Ores contg. the precious metals are treated with cyanide soln. and metallic Hg for rendering the previous metals readily sol. in the cyanide soln.

Continuous sintering of slimy ores. H. G. THORULF. Swed. 63,400, July 26, 1927. A supplement to Swed. 56,556. Transportable sintering pans are used.

Metallurgical process. H. T. DURANT and P. W. RHODES. Can. 273,749, Sept. 13, 1927. Sulfide ores, concentrates or S-contg. metallurgical products are subjected to oxidation by the employment of a soln. contg. CrO_3 as oxidizing agent, the soln. thus obtained being sepd. from the residual solid material and subjected to a purification treatment. The purified soln. is subjected to electrolysis to recover the metals extd.

Recovering metal from blast-furnace slag. F. ROSENZWEIG. U. S. 1,643,610, Sept. 27. Slag contg. metal oxide after flowing from a blast furnace and while still molten is heated by an elec. current to effect reduction of the metal and the latter is recovered. An app. is described.

Roasting sulfides. J. B. READ and M. F. COOLBAUGH. U. S. 1,644,692, Oct. 11. Sulfide ores are fed through a furnace and air for oxidation is fed into the furnace at a point in advance of that at which the sulfides are introduced; a portion of the hot gases travels countercurrent to carry heat to the sulfides introduced and the remainder of the gases travel concurrently with the ore. A furnace with superposed hearths is described.

Sintering apparatus for treating slimy iron ore. KOPPARBERGS OCH HOFORS SÄGERVERKS A.-B. Swed. 62,170, Dec. 28, 1926.

Reduction of metal oxides. H. G. F. CORNELIUS. Swed. 62,390, Feb. 15, 1927. Oxidic ores requiring for their reduction with coal a higher temp. than does ZnO are mixed with an oxidic Zn compd., oxide or silicate, and the mixt. is heated with a sufficient amt. of coal. The Zn will first be reduced, then the ore metal.

Purifying cadmium. H. HOWARD. U. S. 1,644,431, Oct. 4. Cd sponge is treated with 45° Bé. NaOH soln. at its b. p. in sufficient quantity to dissolve the Zn content of the Cd sponge.

Charging and discharging smelting furnaces. FINSPONGS METALLVERKS A.-B. Swed. 62,849, April 27, 1927. An app. is described for charging and discharging metallurgic furnaces, especially elec. furnaces for the melting of brass and similar alloys.

Hearth furnace for heating or melting iron or other metals while enveloped in a protective gas such as carbon monoxide. A. ZILLIACUS. U. S. 1,643,569, Sept. 27.

Replaceable liner for reverberatory furnaces. B. R. KINNEY. U. S. 1,645,011, Oct. 11.

Pure iron. I. G. FARBERIND. A.-G. Brit. 262,938, Dec. 14, 1925. Vapors of Fe carbonyl which may be dild. with inert or with reducing gases and may be under reduced pressure are passed over heated small metal bodies such as Fe turnings or melts or liquids such as molten Fe or oils or melts of $C_{14}H_{10}$ or phenanthrene. The Fe is obtained as a fine powder. A temp. of 250–300° is suitable with Fe carbonyl, N and Fe turnings.

Tempering eutectoid and hypo-eutectoid steel. B. A. KJERRMAN. Swed. 63,136, June 14, 1927. The steel is heated to a temp. within the interval at the lower point of which the dissolution of the cementite starts and at the higher point of which the dissolution of the cementite is accomplished. The temp. is kept at a point below the upper limit of the said interval until the equil. between dissolved and undissolved cementite has been reached, that is about the time required by the steel mass for getting thoroughly warmed or a little longer. Then the steel is cooled slowly and is not heated again.

Heat-treating steel. F. W. GUIBERT. U. S. 1,644,828, Oct. 11. Steel or other metals susceptible of being hardened by similar treatment are heated and quenched while carrying out the entire process *in vacuo* in order to prevent oxidation or discoloration.

Rail steel. J. K. SMITH. U. S. 1,643,321, Sept. 27. Rails are formed of non-heat treated steel contg. C 0.35–0.75, Mn 0.5–1.1, Cu 0.25–1.25, Mo 0.07–1.0% and Si, S and P in about the usual proportions.

Steel for edge tools. A. E. G. T. VON VEGESACK. U. S. 1,644,097, Oct. 4. Steel is used contg. C 0.7–1.1, Cr 10–16, Mn 0.75–2.0% together with Fe and secondary elements in ordinary quantities.

Ferro-chrome alloys. W. B. D. PENNIMAN and E. J. SHACKELFORD. Brit. 262,795, Dec. 11, 1925. Ferro-chrome is decarburized in an arc furnace by melting, adding a reception slag which may comprise lime and fluorspar or may be a slag rich in Cr oxide and poor in Fe oxide, raising the temp., adding Cr ore, and continuing the heating until the C content is sufficiently reduced. Deoxidizing agents such as ferro-Si or the like may be afterwards added. Cf. C. A. 21, 221.

Nickel-manganese steel alloy. C. MCKNIGHT, JR., T. H. WICKENDEN and P. D. MERICA. Can. 274,453. Oct. 4, 1927. A steel contg. 0.50–3.50% Ni, 0.10–0.60% C and 0.70–2% Mn is specified.

Silicon-iron and aluminum-copper alloys. F. D. SHUMAKER. U. S. 1,644,000, Oct. 4. In forming alloys from materials such as bauxite, clay, alunitic or leucite, contg. oxides of Al, Si, Fe and Ti, the aluminous material is electrothermically smelted in the presence of Fe and a flux such as MgO to produce a ferro-Si alloy contg. more or less of the Fe and Ti of the aluminous material treated and a highly aluminous material or slag of low Fe and Ti content but contg. fluxing agent; the flux-bearing slag is then electrothermically smelted in the presence of Cu to produce an Al-Cu alloy low in Fe and Ti.

Silver-silicon alloy. M. G. KORSUNSKY. U. S. 1,643,304, Sept. 27. An alloy which is suitable for making silverware which is resistant to tarnishing contains a preponderating proportion of Ag together with Si 1.5–6.0% and other metals such as Cd, Al, Zn, Sn and Sb which form solid solns. with Ag.

Magnetic alloys. STANDARD TELEPHONES & CABLES, LTD. Brit. 263,059, Aug. 18, 1925. A magnetic material having high permeability and low hysteresis loss with low magnetizing forces comprises Ni (preferably 78.5%), Co (preferably at least 5%) and Fe. Heat-treatment of the product may comprise heating to 1100° and slowly cooling, or heating to 1100°, slowly cooling to near the magnetic transition temp. and then cooling rapidly, or, heating to 1100°, slowly cooling, reheating to the magnetic transition temp. and then cooling rapidly, *e. g.*, at the rate of about 9.5° per sec.

Low-carbon alloys. V. B. BROWN. U. S. 1,645,128, Oct. 11. Heat is supplied by a C arc to a metal bath such as ferrous metal and alloying components such as Cr

or Mn oxides are introduced into the bath while preventing absorption of C by use of an oxidizing slag. An elec. arc furnace with C electrodes is used.

Lead-cadmium alloys. WALTER FRIEDRICH. U. S. 1,645,098, Oct. 11. Cable casings are formed of alloys contg. Pb 99-99.8 and Cd 0.2-1%.

Resistance alloys. T. S. FULLER. U. S. 1,645,099, Oct. 11. Al is alloyed with Mn 4-10 and Zn 2-8%.

Lead alloy. C. T. J. VAUTIN and C. V. STEPHENS. Can. 274,632, Oct. 11, 1927. A lead alloy contg. 1.2% of Cd has an approx. tensile strength of 4700 lbs.

Alloy steel for impact-tools. P. A. E. ARMSTRONG. U. S. 1,645,213, Oct. 11. A tough hard steel contains W 1-2.5, Cr 0.75-1.75, Si 0.05-0.60, Mn 0.05-0.60, C 0.35-0.60, Ta 0.05-0.95%, the remainder being mainly Fe.

Alloy for brake band linings, etc. C. A. GEATY. U. S. 1,644,425, Oct. 4. Pb 95, Sb 3 and Cu 2%

Lined metal pipe. B. TALBOT. U. S. 1,644,361, Oct. 4. A metal pipe which may be formed of Fe or steel is lined with a mixt. of hydrocarbon material such as bitumen, S, pitch and anthracene oil, and a powdery reinforcing material such as ground granite, the proportion of which in the lining increases from the inner or exposed surface of the lining towards the surface in contact with the pipe.

Chill castings. E. KÖTTERITZSCH. Brit. 263,123, Dec. 15, 1925. Mech. features of a process in which molds are filled in stages.

Centrifugal apparatus for casting metals. J. BROWN & CO., LTD. AND M. E. UNWIN. Brit. 262,966, Jan. 8, 1926.

Molds for casting chambered metal bodies. H. KLOUMAN. U. S. 1,643,777, Sept. 27.

Apparatus for casting metals under pressure. O. ECKERT. U. S. 1,644,054, Oct. 4.

Apparatus for casting ingot molds. J. E. PERRY. U. S. 1,643,419, Sept. 27.

Carburizing box. W. B. SULLIVAN. U. S. 1,643,756, Sept. 27. Sheet metal panels are used with a cast metal frame.

Filtering apparatus for galvanization baths. E. HARBECK. Swed. 61,923, Nov. 9, 1926.

Apparatus for igniting the charge in sintering pans. H. G. THORULF. Swed. 62,593, March 15, 1927.

Uniting copper with ferrous metal by an intervening sheet of brass coated with zinc. H. C. MOUGEY. U. S. 1,644,741, Oct. 11.

Counteracting corrosive effects of alcohol and its mixtures on metals. W. OSTWALD. U. S. 1,644,267, Oct. 4. A small proportion of Na benzoate or other suitable benzoate is added to prevent corrosion of metals such as Zn, Fe and Cu with which alc. or fuels or other mixts. contg. alc. may come into contact. Cf. C. A. 21, 2355.

Aluminum solder. V. WHITE. Can. 274,197, Sept. 27, 1927. An Al solder includes Al and Zn as a base and Hg as a flux.

Welding metals by the combined action of electric current and flame. J. F. LAWSON. U. S. 1,643,307, Sept. 27.

10—ORGANIC CHEMISTRY

CHAS. A. ROUILLER AND CLARENCE J. WEST

Recent advances in science: organic chemistry. J. N. E. DAY. *Science Progress* 22, 201-6 (1927).—A review of recent work on the synthesis and structure of thyroxine, and on large straight-chain and ring compds. JOSEPH S. HEPBURN

The relation of the classical stereochemistry to the recent work of K. Weissenberg. M. v. STACKELBERG. *Z. angew. Chem.* 40, 1023-7 (1927).—The new theory of stereochemistry by Weissenberg (see C. A. 20, 3104) is explained by means of simple examples, and discussed with reference to its relation to the older theories of stereochemistry. FREDERICK C. HAHN

Structure of the methane molecule. VICTOR HENRI. *Chem. Reviews* 4, 189-201 (1927).—Application of the modern methods of mol. physics to the study of the structure of the CH₄ mol., and the use of 5 completely independent methods have shown that the 4 valencies of C are not equiv. but consist of 2 different types. The structure of the mol. of CH₄ is pyramidal in form and not tetrahedral as previously assumed. The mol. of CH₄ is a labile system of atoms and is capable of change to other structures in its derivs. 21 references. C. J. WEST

The structure of some methane derivatives. H. MARK AND W. NÖTHLING. *Z.*

Krist. 65, 435-54(1927).— $C(NO_2)_4$, which is cubic at its f. p. $+13^\circ$, has the space group T^4 or T_d^1 . There are 4 mols. in the unit cell and $a = 9.2$ A. U. The trigonal symmetry supports the formula $(NO_2)_3C-O-NO$ proposed by Schmidt. CMe_4 has 8 mols. in the unit cell, with $a = 12.48$. The symmetry does not definitely establish a CH_3 group. Ph_3COH is rhombohedral. The edge of the unit cell is 11.1 A. U., and $a = 17.9$ and $c = 12.5$, with 3 mols. Ph_3CBr is also rhombohedral, with the length of the edge 10.8. There are 3 mols. and $a = 14.05$ and $c = 22.0$. These last 2 compds. belong to space group D_{3d}^5 if they are not polymerized.

L. S. RAMSDELL

Rearrangement of isopropylethylene to trimethylethylene and the pyrogenic decomposition of 2-pentene and trimethylethylene. J. F. NORRIS AND RAYMOND REUTER. *J. Am. Chem. Soc.* 49, 2624-40(1927).—The rearrangement of $Me_2CHCH:CH_2$ to $Me_2C:CHMe$ produced by heat is markedly affected by catalysts; the efficiency increased in the order Al_2O_3 , H_3PO_4 , $Al_2(SO_4)_3$. The rearrangement of $Me_2CHCH:CH_2$ to $Me_2C:CHMe$ which takes place when $Me_2CHCH_2CH_2OH$ is dehydrated by heat is slightly greater than when the hydrocarbon is heated; the efficiency of the catalysts in causing rearrangement is in the same order as above. Under the conditions used $Me_2C:CHMe$ did not rearrange to $Me_2CHCH:CH_2$. When $EtCH:CHMe$ was heated the results showed that no branched-chain hydrocarbons were formed. The pyrogenic decompn. of $EtCH:CHMe$ and $Me_2C:CHMe$ yields gaseous and liquid hydrocarbons, which were analyzed quant. for CH_4 , $MeCH:CHMe$, $(CH_2:CH)_2$, $MeCH:CH_2$, $CH_2:CH_2$ and higher hydrocarbons. From these results the mechanism of the reaction is developed. $Me_2CHCH:CH_2$ is stable toward dil. H_2SO_4 but can be made to rearrange to $Me_2C:CHMe$ to a slight extent by the action of acid of such concn. that polymerization does not take place appreciably. Sp. methods are given for the prepn. of the compds. involved in this study and the following carefully detd. phys. properties are reported: $EtCH:CHMe$, b_{760} $36.39 \pm 0.04^\circ$, m. $-138 \pm 2^\circ$, d_4^{20} 0.65551, d_4^{20} 0.65054, d_4^{20} 0.64537 ± 0.00003 , d_4^{30} 0.64021, n_D 1.3899, 1.3868, 1.3839, 1.3808 and 1.3744 at 5.3, 10, 15, 20 and 30° , resp. $Me_2CHCH:CH_2$, b_{760} $20.10 \pm 0.05^\circ$, becomes a thick sirup at -180° , d_4^{25} 0.63197 ± 0.00002 , n_D 1.3762, 1.3707 and 1.3675 at 0° , 10° and 15° , resp. $Me_2C:CHMe$, b_{760} $38.42 \pm 0.04^\circ$, m. $-123 \pm 2^\circ$, d_4^{25} 0.66708, d_4^{25} 0.65694 (both ± 0.00002), n_D 1.3939, 1.3908, 1.3878, 1.3814, 1.3781 at 10° , 15° , 20° , 30° and 35° , resp. $Me_2CHCH_2CH_2OH$, b_{760} $101.76 \pm 0.04^\circ$, m. $-11.9 \pm 0.5^\circ$, d_4^{25} 0.81382, d_4^{25} 0.80475 (both ± 0.00002), n_D 1.4104, 1.4078, 1.4052 at 10° , 15° and 20° , resp.

C. J. WEST

2-Pentene. J. F. NORRIS. *Org. Syntheses* 7, 76-7(1927).— $PrMeCHOH$ (176 g.), 200 cc. concd. H_2SO_4 and 200 cc. H_2O , heated on a boiling H_2O bath 2-3 hrs., give 65-80% of $EtCH:CHMe$.

C. J. WEST

Preparation of tetramethylethylene. J. C. EARL. *J. Proc. Roy. Soc. N. S. Wales* 61, 68-72(1927).— $EtMe_2COH$ (100 g.) is dehydrated with oxalic acid, giving $Me_2C:CHMe$ (II) (66 g.). II with $HOCl$ gives II-chlorohydrin (38 g.), which by the action of $MeMgI$ (Henry, *Compt. rend.* 144, 311) gives Me_2CHCM_2OH (III) (18 g.). Dehydration of III with dil. H_2SO_4 or concd. aq. soln. of oxalic acid gives $(CMe_2)_2$ (11 g.). The foregoing procedure is simpler, and requires less time than the method given by Thiele.

FREDERICK C. HAHN

Reactivity of atoms and groups in organic compounds. II. Second contribution on the relative reactivities of the hydroxyl-hydrogen atoms in certain alcohols. J. F. NORRIS AND FRANK CORTESE. *J. Am. Chem. Soc.* 49, 2640-50(1927); cf. C. A. 19, 1244. The 2nd-order velocity consts. for the reaction between $p-O_2NC_6H_4COCl$ and the following alcs. are reported: pentan-1-ol, 0.079; hexan-1-ol, 0.85; heptan-1-ol 0.69; 2-methylbutan-1-ol, 0.36; 2-methylpentan-1-ol, 0.34; 3-methylbutan-1-ol, 0.73; 3-methylpentan-1-ol, 0.77; 3-methylhexan-1-ol, 0.75; 4-methylpentan-1-ol, 0.68; pentan-2-ol, 0.0059; hexan-2-ol, 0.0065; pentan-3-ol, 0.0036; heptan-4-ol, 0.0027; 2-methylbutan-2-ol, 0.0025; 3-methylpentan-3-ol, 0.0014; α -phenylethyl alc., 0.00052; α -phenylpropyl alc., 0.00050; α -phenylbutyl alc., 0.00050. From these and previously reported values, 10 conclusions are drawn as to the relation of constitution and this const. The values decrease rapidly with decreasing concn.; in the above values, 1 mol. alc., 1 mol. acyl chloride and 1000 g. Et_2O are used, the temp. being 25° and the deviation of any single detn. from the mean was 2-10%.

C. J. WEST

Activity of fluorine in organic compounds. B. V. TRONOV AND E. A. KRÜGER. *J. Russ. Phys.-Chem. Soc.* 58, 1270-7(1926).— $Me_3CHCH_2CH_2F$, from C_6H_5I and AgF , $d_4^{14.6}$ 0.69945, $d_4^{19.6}$ 0.69415. PhF was prepd. from phenylazopiperidine. In the re-

actions (1) $\text{Me}_2\text{CHCH}_2\text{CH}_2\text{X}$ with piperidine, (2) $\text{Me}_2\text{CHCH}_2\text{CH}_2\text{X}$ with MeONa , (3) PhX with piperidine, and (4) PhX with MeONa , for $\text{X} = \text{F}, \text{Cl}, \text{Br}$ and I , resp., the reactivities are (1) 1, 68.5, 17,800, 50,500; (2) 1, 71.00, 3550, 4500; (3) 1, 1.9, 74.5, 132; (4) 1, 1.8, 4.4, 35.6.

Alkylation by *p*-toluenesulfonic esters. L. BLANCHARD. *Bull. soc. chim.* **41**, 824-33(1927).—Chlorobromohydrin, $b_{197} 197^\circ$, $b_{20} 92^\circ$, chloriodohydrin, $b_{19} 107^\circ$ and chloromethylin were prepd. by treating epichlorohydrin with HBr , HI and MeOH , resp. Conc'd. NaOH with chloromethylin gave *epimethylin*, $b_{170} 113-4^\circ$, $d_4 1.002$, $n 1.41158$. HBr and HI acting on epimethylin gave *bromomethylin*, $b_{12} 79^\circ$, $d_7 1.545$, $n 1.4832$ and *iodomethylin*, $b_{11} 93-4^\circ$, $d_6 1.851$, $n 1.5363$, resp. Condensing the halogen derivs. above with $p\text{-MeC}_6\text{H}_4\text{SO}_3\text{Me}$, B. obtained *methoxy-2-dichloropropane*, $b. 160^\circ$, *methoxy-2-chlorobromopropane*, $b_{18} 70-2^\circ$, $d_{15} 1.54$, $n 1.48519$, *dimethoxy-1,2-chloropropane*, $b. 156-7^\circ$, $d_{15} 1.088$, $n 1.432$. *Methoxy-2-chloriodopropane* decompd. at 140° and could not be obtained by this method. Condensation of $p\text{-MeC}_6\text{H}_4\text{SO}_3\text{Cl}$ and dichlorohydrin in presence of NaOH gave *dichlorohydrin-*p*-toluenesulfonate*, $m. 52-3^\circ$, $b_{13} 180-210^\circ$, $d_{15} 1.356$, $n 1.53572$.

Affinity, reactivity and structure in acetal formation. II. WALTER H. HARTUNG AND HOMER ADKINS. *J. Am. Chem. Soc.* **49**, 2517-24(1927); cf. *C. A.* **19**, 1694.—The equil. const's. for the reaction of EtOH with $\text{H}_2\text{NCH}_2\text{CHO}$, BrCH_2CHO , NCCH_2CHO , $\text{C}_6\text{H}_{11}\text{CHO}$, MeCH_2CHO , $\text{HN}\cdot\text{CHCHO}$, AcH , $\text{C}_2\text{H}_5\text{CH}_2\text{CHO}$, Me_2CHCHO , $\text{CICH}_2\text{CH}_2\text{CHO}$, HOCH_2CHO , $\text{CH}_2\cdot\text{CHCHO}$, BzH , $\text{PhCH}\cdot\text{CHCHO}$ and $\text{MeCH}\cdot\text{CHCHO}$ are given. The values of $-RT\ln K$ have been calcd. and used as the basis for a comparison of the relative affinity manifested by the various aldehydes in the acetal reaction. The effect of a given substituent upon affinity in the acetal reaction is neither quant. nor qual. const. The same substituent in some cases increases and in others decreases affinity. The normal-chain aliphatic aldehydes occupy, within a relatively narrow range, nearly the same position and are very high in the scale, whereas Me_2CHCHO is decidedly lower. Methods for the synthesis of several acetals are given and some of their phys. const's. are reported.

Isopropyl alcohol. H. S. GARLICK. *Ind. Chemist* **3**, 392-4(1927).—The physical and chemical properties of isopropyl alc. are enumerated and discussed, also its physiol. action and its com. possibilities. Its manuf. from "cracking gases" and from acetone is described.

A revision of the pentanols. S. M. GORDON AND EDWARD KREMERS. *J. Am. Pharm. Assocn.* **16**, 222-4, 313-22, 419-25(1927).—Principally a review of the literature with discussion. α -Naphthylurethan of AmOH , $m. 66-7^\circ$; of *sec*- BuCH_2OH , $m. 76^\circ$; of *iso*- BuCH_2OH , $m. 61-2^\circ$; of Et_2CHOH , $m. 68^\circ$; of PrMeCHOH , $m. 76^\circ$; and of *tert*- BuCH_2OH , $m. 71^\circ$. The acid 3-nitrophthalates of several pentanols were prepd. The *m. ps.* lie sufficiently far apart to be of aid in identification; pentyl, $m. 132-3^\circ$; γ -methylbutyl, $m. 165-6^\circ$; β -methylbutyl, $m. 157-8^\circ$; α -methylbutyl, $m. 102-3^\circ$; and α -ethylpropyl, $m. 92^\circ$. Tertiary AmOH did not react.

Methyl amyl ketone. J. R. JOHNSON AND F. D. HAGER. *Org. Syntheses* **7**, 60-2 (1927).—Crude $\text{AcBuCHCO}_2\text{Et}$ (925 g.), added to 5 l. of 5% NaOH and the mixt. stirred at room temp. for 4 hrs., the aq. layer acidified with 500 cc. 50% H_2SO_4 and slowly heated to boiling, gives 52-61% of MeCOAm (based on $\text{AcCH}_2\text{CO}_2\text{Et}$ used).

Nitrosyl chloride and ketones. E. V. LYNN AND F. A. LEE. *J. Am. Pharm. Assocn.* **16**, 309-12(1927); cf. *C. A.* **20**, 3659.—Add one g. mol. of NOCl (calcd. from the sulfate) to one of Me_2CO , keeping the latter cool. When the reaction is complete, remove the excess of Me_2CO and HCl by direct distn. Subject the residue to vacuum distn. and set the distillate aside in a freezing mixt. Collect the sepd. crystals and recrystallize from H_2O . Phorone mononitrosochloride, $m. 174^\circ$. Me_2CO reacts under varying circumstances to give isonitrosoacetone, chloroisnitrosoacetone, phorone mononitrosochloride, and probably phorone dinitrosochloride. MeEtCO gives the corresponding isonitroso compd. Dipropyl ketone gives an isonitroso compd.

Nitrogen trichloride and unsaturated ketones. G. H. COLEMAN AND DAVID CRAIG. *J. Am. Chem. Soc.* **49**, 2593-6(1927).— $\text{PhCH}\cdot\text{CHBz}$ (120 g.) in 800 cc. CCl_4 , cooled to 0° , treated with 220 mg. mols. of NCl_3 in 350 cc. CCl_4 , and shaken with 50 cc. conc'd. HCl gives among other products about 10% of the HCl salt of *1-amino-2-chloro-1,3-diphenylpropan-3-one*, $m. 206-8^\circ$ (decompn.); *Bz deriv.*, $m. 186-7^\circ$. Reduction with Na-Hg gives *1-amino-1,3-diphenylpropan-3-ol*, $m. 122-4^\circ$, which was also obtained by the reduction of $\text{PhC}(\text{NOH})\text{CH}_2\text{Bz}$ with Na-Hg .

Hydrogen cyanide (anhydrous). K. ZIEGLER. *Org. Syntheses* **7**, 50-2(1927).—

Details of app. and method for prep. HCN from NaCN and H_2SO_4 ; 93-7% yields.

C. J. WEST

Preparation and saponification of esters by the distillation method. II. Preparation of isoamyl acetate. L. GAY, P. MION AND M. AUMERAS. *Bull. soc. chim.* 41, 1027-40(1927); cf. C. A. 21, 1048.—A mixt. of iso-AmOH, AcOH, iso-AmOAc and H_2O has a min. dew point at 94° ; it corresponds to a binary mixt. of 0.788 mol. H_2O and 0.212 mol. ester. The results obtained in the present expts. refer to the case of the first distillate being a binary mixt., and were foretold in the previous theoretical study. Iso-AmOAc is very advantageously prepd. from an equimolar mixt. of alc. and acid because the residue of the distn. is practically pure ester, and the difficult sepn. of the acetate from the excess of alc. or acid is thus avoided.

A. L. HENNE

Salts of α -linolic tetrabromide (sodium, potassium, zinc, barium, calcium and strontium) from Philippine lumbang oil. ADELAIDA T. ORETA AND A. P. WEST. *Philippine J. Sci.* 33, 169-76(1927).— α -Linolic tetrabromide, $CH_3(CH_2)_4(CHBr)_2CH_2(CHBr)_2(CH_2)_7CO_2H$, m. p. $112.3-114.3^\circ$, has been prepared from lumbang oil. Its Na and K salts were prepared by treating the free acid in EtOH with an alc. soln. of the corresponding alkali. From the K salt, the Zn, Ba, Ca and Sr salts have been prepared. The m. ps. are: K: $154.7-8.8^\circ$; Ca: $208.7-13.4^\circ$; Sr: $200.4-6^\circ$; Ba: $196.3-206.5^\circ$; Na: $194.2-201.1^\circ$, all but the K salt decomp. during the melting. The solubilities of the various salts in 17 org. solvents have been qual. determined.

A. L. HENNE

Salts of linolenic hexabromide (Ca, Mg, Sr, and Ni) from Philippine lumbang oil. P. R. ALMORADIE AND A. P. WEST. *Philippine J. Sci.* 33, 257-63(1927).—Ca, Mg, Sr, and Ni salts of linolenic hexabromide were prepd. from the K salt by pptn. from PrOH soln. with the corresponding metal bromides (except $SrCl_2$). They decompose at $208-18^\circ$.

DAVID DAVIDSON

Condensation of ethylene oxides with alcohols in the presence of sulfuric acid as a catalyst. II. E. FOURNEAU AND I. RIBAS. *Bull. soc. chim.* 41, 1046-56(1927); cf. C. A. 21, 567.—The condensation of CH_3CH_2O (I), $ClCH_2CH_2O$ (II), and $EtMcCCH_2O$ (III), with $HOCH_2CH_2Cl$ (IV), in the presence of H_2SO_4 is studied. I and IV give 24-30% of $OCH_2CH_2OCH_2CH_2Cl$ (V),

20-25% of $HOCH_2CH_2OCH_2CH_2OCH_2CH_2Cl$ (VI). Me_2NH and V yield $HOCH_2CH_2OCH_2CH_2CH_2NMe_2$ (VII); the same reagent with VI gives $HOCH_2CH_2OCH_2CH_2OCH_2CH_2CH_2NMe_2$ (VIII). The benzoate and cinnamate esters of VII and VIII are local anesthetics; their picrates and hydrochlorides are very sol. in H_2O and very hygroscopic; their aq. solns. are neutral. II and IV yield 70% of $ClCH_2CH(OH)CH_2OCH_2CH_2Cl$ (IX), $b_{18} 123.5^\circ$. Me_2NH and IX give $Me_2NCH_2CH(OH)CH_2OCH_2CH_2NMe_2$ (X) (80-90% yield). The picrate of X is oily and barely sol. in H_2O or alc. The Bz ester crystals easily but is very hygroscopic. It does not exhibit any anesthetic property. III and IV in the presence of H_2SO_4 give a compd. $b_{18} 75^\circ$, which is possibly $MeEtCCH_2OC(MeEt)CH_2O$. In the absence of H_2SO_4 , and after a long heating,

$MeEtC(OH)CH_2OCH_2CH_2Cl$ (XI), $b_{18} 115-20^\circ$, is obtained. Me_2NH and XI give $MeEtC(OH)CH_2OCH_2CH_2NMe_2$ (60% yield), an oily liquid, very sol. in H_2O and in org. solvents. Its esters have a strong anesthetic power; their salts (picrate, chloride) cryst. easily.

A. L. HENNE

Chloroacetamide. W. A. JACOBS AND M. HEIDELBERGER. *Org. Syntheses* 7, 16-7(1927).— $ClCH_2CO_2Et$ and NH_3 at $0-5^\circ$ give 78-84% of $ClCH_2CONH_2$, m. $118-9^\circ$; recrystn. gives a pure product.

C. J. WEST

β -Hydroxypropionic acid. R. R. READ. *Org. Syntheses* 7, 54-6(1927).— $HOCH_2CH_2CN$ (250 g.), slowly added to a cold soln. of 160 g. NaOH in 500 cc. H_2O , the mixt. allowed to stand overnight at 30° , then slowly heated to 80° during 4 hrs., the mixt. evapd. to dryness in vacuo, 50 cc. H_2O added and then a mixt. of 200 g. concd. H_2SO_4 and 300 cc. H_2O , gives 28-31% of a liquid contg. 75-80% of $HOCH_2CH_2CO_2H$.

C. J. WEST

Ethyl butylacetoacetate. C. S. MARVEL AND F. D. HAGER. *Org. Syntheses* 7, 36-8(1927).—Detailed directions are given for the prepn. of $AcBuCHCO_2Et$ from $AcCH_2CO_2Et$, $EtONa$ and $BuBr$; the yields are 69-72%.

C. J. WEST

The so-called diethyl dicyanoglutaconate and some of its derivatives. II. YOSHIO YUKI URUSHIBARA. *Bull. Chem. Soc. Japan* 2, 236-41(1927); cf. C. A. 21, 1248.—The so-called diethyl dicyanoglutaconate (I) is to be distinguished from the real one (II) by the fact that its mol. contains one half mol. H_2O which cannot be removed.

II is not known in its free state. The mechanism of formation of the Na deriv. of II has been studied in the reactions already given in the literature, and the yields improved. The product having been obtained in a high degree of purity, the metallic salts obtained from it exhibited their true colorations; the Na deriv. is colorless; the Ag deriv. is a gelatinous ppt., transformed into a powder by heating; the Cu deriv. is pink-red, then turns reddish brown; the addition of NH_3 changes it into a white ppt., the supernatant liquid being bluish; the NH_4 deriv. is analogous to the Na deriv. By acidifying the hot aq. soln. of the Na deriv. of II, yellow crystals of I were pptd. The formula is $\text{C}_9\text{H}_8\text{O}_4\text{N}_2 \cdot \frac{1}{2}\text{H}_2\text{O}$, m. 225° . When Br is added to a suspension of I in CHCl_3 , a ppt. of no definite formula is obtained. It is collected and put into moist ether. A white solid is obtained, which is dissolved in alc., and an alc. soln. of picric acid is added. The picrate of dimethyl dicarbamylglutaconate, $\text{C}_6\text{H}_{12}\text{O}_6\text{N}_2\text{C}_6\text{H}_5\text{OH}(\text{NO}_2)_3$, is thus pptd.

A. L. HENNE

Guanidine nitrate. T. L. DAVIS. *Org. Syntheses* 7, 46-8(1927).— $\text{H}_2\text{NC}(\text{NH})\text{NHCN}$ and NH_4NO_3 , heated at 160° for 3 hrs., give 85-92% of $\text{H}_2\text{NC}(\text{NH})\text{NHNO}_3$.

C. J. WEST

Nitroguanidine. T. L. DAVIS. *Org. Syntheses* 7, 68-9(1927).—Crude $\text{H}_2\text{NC}(\text{NH})\text{NH}_2 \cdot \text{HNO}_3$ (560 g.) slowly added to 500 cc. cooled concd. H_2SO_4 and allowed to stand at room temp. until homogeneous, gives 73-5% of $\text{H}_2\text{NC}(\text{NH})\text{NHNO}_2$.

C. J. WEST

Preparation of ethoxallic acid and its chloride. E. FOURNEAU AND S. SABETAY. *Bull. soc. chim.* 41, 537-40(1927).— $(\text{CO}_2\text{Et})_2$ heated with anhyd. $\text{H}_2\text{C}_2\text{O}_4$ in excess at 130° gave a mono Et ester, which can be converted into ethoxalyl chloride by heating with SOCl_2 .

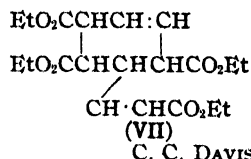
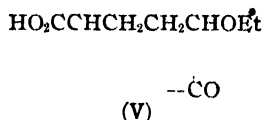
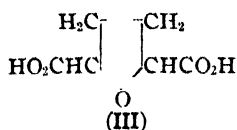
R. C. ROBERTS

Ethyl bromomalonate. C. S. PALMER AND P. W. MCWHERTER. *Org. Syntheses* 7, 34 5(1927).— $\text{CH}_2(\text{CO}_2\text{Et})_2$ is brominated in CCl_4 ; the yield of $\text{BrCH}(\text{CO}_2\text{Et})_2$ is 73-5%.

C. J. WEST

The action of sodium ethylate on the ethyl ester of 1,4-dibromoadipic acid. Polymers of muconic acid esters. KURT VOGT. *Mitt. schlesischen Kohlenforsch. Kaiser-Wilhelm Ges.* 2, 69-96(1925); *Chem. Zentr.* 1926, I, 2340-2.—To det. whether CO_2H and CO_2R groups have any influence on the polymerization of groups in butadiene, a study was made of muconic acid, $\text{HO}_2\text{CCH}:\text{CHCH}:\text{CHCO}_2\text{H}$ (I), and its esters. A satisfactory process for the prepn. of adipic acid, the necessary initial compd., was first developed. It was then converted to di-Et 1,4-dibromoadipate (II) by the method of Stephen and Weizmann (*C. A.* 7, 1707). By the action of NaOEt soln. on II, there was formed I by the splitting off of 2 HBr, tetrahydrofurandicarboxylic acid (III) by exchange of the Br atoms by OH and sepn. of H_2O , 1,4-diethoxyadipic acid (IV) and 1-hydroxy-4-ethoxyadipic acid lactone (V) by exchange of 1 Br atom by OEt , of the other Br by OH and sepn. of H_2O . V is characterized by the great stability of the lactone ring. Di-Et muconate was best adapted for polymerization expts. at high temps. From the resinous product a dimer ester was isolated, the compn. of which should be (VII) by analogy with the expts. of Hofmann on butadiene. This formula could not be verified because of insufficient material. Unlike polymers of butadiene and its derivs., the polymer with high h. p. did not resemble rubber, and its soly. was far different. Vulcanization tests were not carried out. Adipic acid was prepd. by oxidation of cyclohexene with KMnO_4 and o-quinite, or more readily by adding cyclohexanol to boiling HNO_3 (6 parts of d. 1.4). The acid was dissolved in boiling SOCl_2 , brominated and poured into EtOH, which yielded II, m. 65° . II (140 g.) in EtOH, boiled 1 hr. with Na (70 g.) in EtOH (1750 cc.), cooled, the ppt. dissolved in a little water and acidified with concd. H_2SO_4 , ppts. about 32% of I, decomps. $306-7^\circ$, not attacked by boiling AcCl , Ac_2O or SOCl_2 . The acid filtrate concd. and extd. with EtO, gives an oil and a cryst. substance. The latter on recrystn. yields 14-54% of III, m. $123-4^\circ$. The oil distd. in vacuo, fractionated, ketones removed with semicarbazide, the oil again distd. in vacuo, yields the anhydride of IV, $\text{C}_{10}\text{H}_{16}\text{O}_6$, b₁ $121-2^\circ$. Treated with cold concd. NaOH it forms 1,4-diethoxyadipic acid, oil. The oil also yields V, highly acidic, b₁ $130-2^\circ$. Alc. V satd. with HCl gas and boiled forms an oil, b₁ $122-3^\circ$. Et ester, $\text{C}_{10}\text{H}_{16}\text{O}_6$. Amide, $\text{C}_9\text{H}_{13}\text{O}_4\text{N}$, by treating the Et ester for 8 days with cold concd. NH_4OH , m. $203-6^\circ$. The di-Me ester of I, m. 154° , is prepd. from the acid chloride of I (which is prepd. from I and PCl_5 or POCl_3), from I and CH_3N_2 in EtOH, from I, Me_2SO , and NaOH, and from I in MeOH satd. with HCl gas and boiled. The di-Et ester (VI) of I, m. 64° , is prepd. by heating I with EtOH for 2 hrs. at 200° in a sealed tube, giving 14% yield, or better from I in EtOH satd. with HCl and boiled. For the polymerization, VI was heated in a tube 5 hrs. at 180° . Nothing was recovered on steam distn. of the resinous product.

but on distn. *in vacuo* (1 mm. Hg), the chief product b_1 208–30°. On fractionation this yielded the *dimer* of VI, with the compn. VII, green-yellow sirup with aromatic odor, b_1 221–2°, not saponif. by alc. KOH. The residue from this last distn. was a black pitch, which on sapon. with alc. KOH gave a coffee-brown adhesive product.



The Sicilian citric acid industry. ERICH GUTTMANN AND FRIEDRICH KLEMA. *Chem.-Ztg.* 51, 705–6, 726–7 (1927).

Preparation of cephalin. P. A. LEVENE AND IDA P. ROLF. *J. Biol. Chem.* 74, 713–4 (1927).—Brain tissue (40 lbs.), after drying, is extd. with about 20 l. Me_2CO , dried, extd. with 30 l. 95% EtOH and then with 20 l. Et_2O ; the concd. Et_2O ext. is allowed to stand overnight at 0°, centrifuged and the supernatant liquor poured into 98.5% EtOH at 60°; the ppt. is again dissolved in Et_2O , allowed to stand at 0° and the operation repeated as long as the Et_2O ext. deposits a sediment of white matter. The final product formed by pptn. with EtOH contains no $\text{NH}_2\text{-N}$. The yield is 18 g.

C. J. WEST

Progress in the structural study of carbohydrates. J. C. IRVINE. *Reviews* 4, 203–29 (1927).—Willard Gibbs medal award address.

C. J. WEST

Action of hydrochloric and of hydrobromic acids on sugars. H. COLIN AND (MLLE.) E. RUPPOL. *Bull. soc. chim. biol.* 9, 928–31 (1927).—The color reactions observed by Fenton and Gostling (cf. *J. Chem. Soc.* 73, 554; 79, 361) when various sugars are treated with HCl or HBr are reviewed and are repeated under varying conditions respecting the presence of moisture.

L. W. RIGGS

Diacetoneglucose. IV. α - and β -Isomers of 3,5,6-trimethylmethylglucoside and of 2,3,5,6-tetramethylmethylglucoside. P. A. LEVENE AND G. M. MEYER. *J. Biol. Chem.* 74, 701–11 (1927); cf. *C. A.* 21, 63.—The 3,5,6-trimethylmethylglucosides obtained from the monoacetone deriv. with MeOH contg. 0.5% HCl may be fractionated into the α -form, $b_{0.4}$ 105–9°, $[\alpha]_D^{20}$ 93° (MeOH) and the β -form, $b_{0.2}$ 145–50°, $[\alpha]_D^{20}$ 87°; both forms give an equil. value of about -12.5° to -13° (tables showing the rate of mutarotation in MeOH contg. 0.2% HCl are given); the velocities of inter-conversion are of the same order of magnitude. That the 2 compds. are the α - and β -forms is further confirmed by their hydrolysis and oxidation. Further methylation with an excess of MeI gives the 2,3,5,6-tetra-Me derivs., $b_{0.2}$ 105°, $[\alpha]_D^{20}$ 104° (MeOH) and 64°; the equil. rotations are $[\alpha]_D^{24}$ -22.5° and -17.7° . Hydrolysis gives tetramethylglucose with $[\alpha]_D^{20}$ -17.1° ; the *l*-rotatory fraction was contaminated with the *d*-form, so that the sugar has $[\alpha]_D^{20}$ -13.5° . The rates of mutarotation were practically the same. The rotation of the C atom (1) of the β forms has a higher value than that of the common forms.

C. J. WEST

α -Methyl mannoside. C. S. HUDSON. *Org. Syntheses* 7, 64–6 (1927).—Vegetable ivory waste (1 kg.) is kneaded with 1250 g. 85% H_2SO_4 , allowed to stand 15 hrs. at 25°, then a mixt. of 1 l. MeOH and 250 cc. concd. HCl added and the mixt. refluxed 8 hrs.; 480–520 g. α -methyl mannoside seps. from the light yellow filtrate.

C. J. W.

Pentamethyl-*d*-mannose and pentamethyl-*d*-galactose and their dimethyl acetals. P. A. LEVENE AND G. M. MEYER. *J. Biol. Chem.* 74, 695–9 (1927).—Detailed directions are given for the prepn. of diethylmercaptomannose. Methylation, 1st with Me_2SO_4 and NaOH and then with Na and MeI (cf. *C. A.* 20, 2987), gives pentamethyl-diethylmercaptomannose, $b_{0.2}$ 155–60°, $[\alpha]_D^{20}$ 39.4° (MeOH); hydrolysis with HgCl_2 in MeOH gives pentamethyl-*d*-mannose, $b_{0.1}$ 98–100°, $[\alpha]_D^{20}$ 9.1° ($\text{C}_2\text{H}_5\text{Cl}$), $[\alpha]_D^{25}$ 8.00° (MeOH); at room temp. in 10 min., $[\alpha]_D^{20}$ 12.30° and finally gives the equil. value of 17.8°; the deriv. reduces Fehling soln. on warming and alk. AgNO_3 in the cold. The dimethyl acetal, $b_{0.1}$ 112–4°, $[\alpha]_D^{20}$ 21.2° (MeOH) and 19.3° ($\text{C}_2\text{H}_5\text{Cl}$). Pentamethyl-diethylmercaptogalactose, $b_{0.1}$ 155–60°, optically inactive in 11% MeOH soln. Pentamethyl-*d*-galactose, $[\alpha]_D^{20}$ -4.8° ($\text{C}_2\text{H}_5\text{Cl}$); in MeOH (c 4.54), there was no appreciable rotation at the time of mixing, after 1 hr. $[\alpha]_D^{20}$ is -6° and finally reaches the equil. value of -10° ; in MeOH contg. 0.2% HCl, the equil. value is immediately reached. The dimethylacetal, $b_{0.1}$ 118–20°.

C. J. WEST

Effect of ionization upon optical rotation. III. Relation in the 2,5-anhydro sugar acids. P. A. LEVENE and LAWRENCE W. BASS. *J. Biol. Chem.* **74**, 727-37(1927); cf. *C. A.* **21**, 1965.—Titration-rotation data have been detd. for mannonic (I), 2,5-anhydromannonic (II), mannosaccharic (III), 2,5-anhydromannosaccharic (IV), and 2,5-anhydrosaccharic (V) acids. From these data accurate values of the rotations of the different mol. species have been calcd. The $[M_m]$ values reported are: I, -24.2° ; II, 81.1° ; III, 40° ; IV, 112.4° ; V, 102.0° . A comparison of these rotation values shows that the presence of a stabilizing ring decreases the change in rotation on passing from 1 mol. species to another. A comparison of the data for IV and V shows that the change in rotation on passing from 1 mol. species to another is roughly proportional to the distance traversed by the ionizable groups during the transformation, as measured by means of structural models. The original should be consulted for the detailed measurements. C. J. WEST

Hydroxyamino compounds which show the biuret reaction. III. Resolution of γ -amino- β -hydroxybutyric acid into the optically active components. MASAJI TOMITA and YUZO SENDJU. *Z. physiol. Chem.* **169**, 263-77(1927); cf. *C. A.* **21**, 62.—By means of brucine, *dl*-BzNHCH₂CH(OH)CH₂CO₂H was sepd. into the *l*- and *d*-salts, m. 87° and 41° , resp. Removal of brucine and crystn. of the free acid gave in each case 2 pairs of isomers: *l*- γ -benzamido- β -hydroxybutyric acid, m. 172° , $[\alpha]_D^{20} -7.59$ (I) and m. 114° , $[\alpha]_D^{20} -11.84^\circ$ (II), resp., and the corresponding *d*-acid, m. 178° , $[\alpha]_D^{20} 4.08^\circ$ (III) and m. 116° , $[\alpha]_D^{20} 10.0^\circ$ (IV), resp. II and IV m. $80-1^\circ$ and $78-80^\circ$, resp., before removal of H₂O of crystn. Removal of Bz by hydrolysis gave 4 corresponding γ -amino- β -hydroxybutyric acids, m. 213° , $[\alpha]_D^{20} -3.40^\circ$, m. 212° , $[\alpha]_D^{20} -21.06^\circ$, m. 214° , $[\alpha]_D^{20} 3.21^\circ$ and m. 214° , $[\alpha]_D^{20} 18.30^\circ$, resp. Complete methylation of these 4 amino acids with MeI and KOH in MeOH gave 4 γ -trimethyl- β -hydroxybutyrobetaines: $[\alpha]_D^{20} -7.25^\circ$, AuCl₃ salt m. $151-2^\circ$; $[\alpha]_D^{20} -20.98^\circ$ (IIa), AuCl₃ salt m. 155° , PtCl₄ salt m. 200° , HgCl₂ salt m. 204° ; $[\alpha]_D^{20} 8.42^\circ$, AuCl₃ salt m. $150-1^\circ$; and $[\alpha]_D^{20} 20.20^\circ$, AuCl₃ salt m. 155° . IIa is identical with carnitine. The isomerism of the *2l* and the *2d* forms in these series is due, not to a 2nd asymmetric C atom, but to the lack of a plane of symmetry in their spatial formulas. A. W. DOX

Proteins. IV. STEFAN GOLDSCHMIDT, EGON WIEBERG, FRIEDRICH NAGEL and KARL MARTIN. *Ann.* **456**, 1-38(1927); cf. *C. A.* **21**, 1990.—1. *The degradation of polypeptides and amino acids by hypobromite* (Wieberg). Benzoylleucylglycine and the 2 diastereoisomeric forms of benzoylleucylalanylglycine are stable toward HOBr as long as hydrolytic splitting is avoided. Thus it may be considered proved that the NHCO linkage in open polypeptide chains is stable toward HOBr. The nonacetylated polypeptides behave differently toward HOBr depending upon whether an alk. or neutral medium is used; in about 0.2 *N* alkali, 2 mols. HOBr are quickly used up (1-2 min.), while in neutral soln. (about 0.001 *N* alkali), there is a rapid utilization of 1 mol HBr and then a slow utilization of about 1.5 mols. with evolution of N. The reaction between NH₂ acids and HOBr is independent of the alkali concn., 2 mols. HOBr being used. In neutral soln. the keto acid corresponding to the dipeptide is obtained; thus leucylglycine gives [2-methyl-4-ketovaleryl]glycine, analyzed as the hydrazone, golden yellow, m. 200° ; valylglycine gives [2-methyl-3-ketobutyl]glycine hydrazone, m. 152° . In the alk. reaction a nitrile and an NH₂ acid are obtained; thus, valylglycine gives isobutyronitrile and glycine. Leucine in neutral KOBr gives isovaleronitrile; if the aq. soln. is covered with Et₂O, there is obtained in addn. to the nitrile, the aldehyde, resulting from the intermediate imine. 2. *Action of hypobromite on diketopiperazines* (Nagel). In neutral soln. there is no decompn. but only a *N*-bromination of the diketopiperazine ring. *N*-Dibromovalanine anhydride, decompn. 110° (70% yield); *N*-dibromoleucine anhydride, m. 269° . In the alk. decompn. alanine anhydride gives alanine-HBr, AcOH and NH₃; leucine anhydride, isobutylhydantoin and C₆H₅CO₂H. Pyrrolidonecarboxylic acids and their esters are not attacked by hypobromite. 3. *Degradation of egg albumin by hypobromite* (Martin). From the reaction product of 50 g. albumin in 500 cc. H₂O, treated with 106 cc. Br, 310 g. KOH and 4 l. H₂O at -2° , there seps. about 1 g. of the compd. C₂Br₄O₃S, m. 134° , reduced by HI to a compd. m. $161-2^\circ$. There are also isolated (CH₂CO₂H)₂, BzOH, AcOH and valeronitrile. C. J. WEST

Racemization. V. Action of alkali on gelatin. P. A. LEVENE and L. W. BASS. *J. Biol. Chem.* **74**, 715-25(1927); cf. *C. A.* **21**, 97.—The rotations and NH₂:N ratios have been detd. for the mixt. of NH₂ acids obtained from gelatin by acid hydrolysis under different conditions, among which was the previous action of alkali at 25° . In gelatin racemization of some of the NH₂ acids occurs on treatment with 0.1 *N* and with 1.0 *N*

alkali but not on treatment with 3.0 *N* alkali. The absence of racemization in the 3rd case is explained by the fact that under these conditions the rate of hydrolysis is higher than the rate of racemization. These results, when compared with previous results on the racemization of ketopiperazines, indicate the possibility of the presence of ketopiperazines in the gelatin mol. The results are in harmony with the data of Dakin on the racemization of gelatin by alkali on 1 hand and on the hydrolytic products of gelatin on the other.

C. J. WEST

Aromatic and hydroaromatic compounds of lignite tar. I. J. HERZENBERG AND S. RUHEMANN. *Braunkohle* 26, 526-32(1927); see *C. A.* 21, 2122. II. J. HERZENBERG AND S. RUHEMANN. *Ibid* 558-64.—Attempts to isolate the hydroaromatic hydrocarbons, as such, from the 120-6° fraction, gave negative results. Br and anhyd. HCl each gave only resin, and cold concd. H₂SO₄ produced not only sulfonation but dehydrogenation as well. Pure cadinene behaved similarly. This is unfavorable to the use of H₂SO₄ as a refining agent for tar-benzine, etc.

F. S. GRANGER

Chemical properties of limonene. A. AUDRAIN. *Bull. inst. pin* 1927, 33-4 55-6, 91-2, 183-90; *Pine Inst. America Abstracts* 1, 24(1927).—A survey of the literature concerning the prepn. and chem. properties of limonene, with numerous references and a bibliography. Directions are given for the lab. prepn. of limonene and its various derivs.

A. PAPINEAU-COUTURE

The course of simple transformations of tautomeric compounds. K. VON AUWERS, G. WEGENER AND TH. BAHR. *Sitz.-Ber. Ges. Bef. ges. Naturwiss. Marburg* 1925, 18 pp.; *Chem. Zentr.* 1926, 1, 2347-8.—To explain the formation of *C*-substituents from salts of keto-enols and alkyl halides ("abnormal" transformation), 3 hypotheses have been advanced: (1) the initial formation of addn. products with subsequent splitting (Michael); (2) the initial formation of normal *O* derivs., with rearrangement of these into *C* derivs., and (3) the sepn. of the metal as a metallic halide, formation of free alkyl

and enol radicals, $\begin{array}{c} \text{---C=C<} \\ | \\ \text{O} \end{array} \rightarrow \begin{array}{c} \text{---C-C<} \\ || \quad | \\ \text{O} \end{array}$ and with the slight reactivity of the

alkyl group partial or complete rearrangement of the enol to keto radical, and finally union of the radicals (Wislicenus). Recent investigations have shown that the course of the alkylation of a keto-enol depends upon its character and upon the alkylation agent. Examples are cited. New expts. with esters of hydroxycoumarilic acid and with 1-cyano-2-cyclohexanone show that satd. alkyl halides promote the formation of *O* derivs. and allyl and benzyl halides promote the formation of *C* derivs. This conforms with the recent expts. of Claisen (*C. A.* 19, 2038) on the alkylation of phenols. Here too allyl, benzyl and similar radicals furnish preponderantly *C* derivs. and satd. alkyl radicals form *O* derivs. At the same time, inactive media favor the formation of *C* derivs. and dissociating media that of *O* derivs. These facts are well explained by the first hypothesis, on which the theoretical considerations of Claisen are also based. *In dissociating media the exchange between the ions is more strongly manifest. The second hypothesis is inadequate, for it is not comprehensible why an *O*-ether should be transformed into a *C* deriv. in C₆H₆ more easily than in EtOH. According to the third hypothesis, *O*-ethers should be formed with allyl and with benzyl radicals because of their great reactivity, but this is not the case. Nevertheless the formation of radicals and the isomerization of enol to keto radicals is necessary to explain the reactions. Since allyl and benzyl radicals are distinguished by their slight valence requirements and therefore hold O only loosely, they show a preference for combining with C to form a stabile combination. Tautomerism in pyrazoles, indazoles and tetrahydroindazoles are then discussed, with special reference to their reactions with alkyl halides. Works of A. and his collaborators and numerous previous works are cited. In general the reactions are comprehensible if they are regarded partly as substitution, partly as addn. reactions. In the first case the H or the Na bound to N replaces directly the radical of the alkyl halide, in the second case the alkyl halide adds to the tertiary N and then the H halide or Na halide is evolved. The very complicated reactions of Ag indazole with alkyl halides can perhaps be understood if the intermediate formation of radicals as with

keto-enols $\begin{array}{c} \text{CH} \\ \diagup \quad \diagdown \\ \text{C}_6\text{H}_4 \quad \text{N} \\ \diagdown \quad \diagup \\ \text{N} \end{array} \rightleftharpoons \begin{array}{c} \text{CH} \\ \diagup \quad \diagdown \\ \text{C}_6\text{H}_4 \quad \text{N} \text{---} \\ \diagdown \quad \diagup \\ \text{N} \end{array}$ is assumed, and the different affinity

characteristics of the alkyl radicals are taken into account.

C. C. DAVIS

The constitution of the Grignard organomagnesium derivatives. D. IVANOV. *Compt. rend.* 185, 505-7(1927); cf. following abstract.—The purpose of the work is to find arguments for making a choice between the asymmetric formula RMgX proposed

by Grignard, and the symmetric formula $R_2Mg \cdot MgX_2$ given by Jolibois. The product obtained by the carbonation of the Grignard reagent is extd. with dry Et_2O . It is assumed that the Mg halide must not be removed, if the compd. has the asymmetric formula RCO_2MgX , and that it must be extd. if it has the symmetric formula $(RCO_2)_2Mg \cdot MgX_2$. I. succeeded in extg. in this way about 30% of the Mg halide, and consequently adopts the formula of Jolibois.

A. L. HENNE

Remarks to the note of Ivanov: "Constitution of the Grignard organomagnesium derivatives." V. GRIGNARD. *Compt. rend.* 185, 507-9(1927); cf. preceding abstract.—The soly. of $MgBr_2$ in Et_2O is 45% at 28° and 0.08% at 0°. After a very long extn., Ivanov succeeded in removing only 30% of the $MgBr_2$ present in the Grignard reagent. This fact must be considered as an argument against the formula of Jolibois. It may be admitted that in the Grignard reagent an equil. exists between the two formulas, but in that case, only a very minute quantity of the compd. would have the symmetric formula.

A. L. HENNE

Use of nitrogen tetroxide in place of nitric acid in organic nitrations. L. A. PINCK. *J. Am. Chem. Soc.* 49, 2536-9(1927).—A method for the nitration of org. substances with N_2O_4 in the presence of H_2SO_4 is described, C_6H_6 , $PhNO_2$, $PhMe$ and $C_{10}H_8$ being used as examples. The method involves the intermediate reaction of the N_2O_4 with the H_2SO_4 , whereby nitrating and dehydrating reagents are simultaneously formed. The yields of the NO_2 compds. range from 87% to upwards of 90% of the theoretical.

C. J. WEST

3,5-Dinitroanisole. FREDERIC REVERDIN. *Org. Syntheses* 7, 28-9(1927).—1,3,5- $C_6H_3(NO_2)_3$ and $MeONa$ give 63-77% of 3,5- $(O_2N)_2C_6H_3OMe$.

C. J. WEST

Terpineol from terpinol hydrate. A. ROBERT. *Bull. inst. pin* 1927, 153-6, 177-82; *Pine Inst. America Abstracts* 1, 24(1927).—Essentially a crit. review. A considerable amount of Wallach's work has been repeated and substantiated. Optimum conditions for the prepn. of terpineol from terpinol hydrate were found to be rapid heating in presence of H_2SO_4 (1/1500-1/2000) or phosphoric acid (1/1500). Industrial terpineol consists mainly of α -, a small proportion of γ -, and only traces of β -terpineol. The 2 former were sepd. in cryst. form by repeated crystns.

A. P.-C.

Genetic relation of terpenes. OSSIAN ASCHAN. *Svensk Kem. Tids.* 39, 165-78 (1927).—An address illustrated by many formulas showing the relationship of the terpenes and developing the hypothesis of their common origin by way of isoprene.

A. R. ROSE

Pyrogenic oxidation of oil of turpentine in the presence of a copper catalyst. F. ORLOV. *Ukrainskii Khim. Zhurnal* 2, 1-6; *Chem. Zentr.* 1926, II, 660.—When a mixt. of oil of turpentine vapor and air is conducted through a Cu net heated to 400°, the oil is decompd. and oxidized, and the heat of oxidation then maintains the Cu in a glowing condition without external heat being supplied any longer. Among the reaction products were CO , CO_2 and ethylene hydrocarbons, 0.8-21% of water-sol. substances and 60-70% of oil, about 75% of the latter distg. between 160° and 183°. This 160-183° fraction contained cymene, had a pleasant odor and was suitable for use in perfumery. When the mixt. which was passed over Cu was composed of oil of turpentine, air and water vapor, the yield of oil was reduced to 40-50%.

C. C. DAVIS

A few notes on the hydration of nopinene. IV. Comparison of the hydration of pinene and of nopinene. G. AUSTERWEIL. *Bull. soc. chim.* 41, 1088-94(1927); cf. C. A. 21, 1806.—The limonene obtained with the use of heat during the reaction between org. acids and nopinene does not seem to come from pinene formed as an intermediary product. Pinene treated with org. acids yields bornyl esters; the reaction is bimolecular. The isomerization of pinene into limonene is a monomolecular reaction. The velocities of both are smaller than in the case of nopinene treated with the same acids.

A. L. HENNE

The crystalline products formed in the action of aromatic amines on thiosemicarbazide and its derivatives. I. MATZUREVICH. *Bull. soc. chim.* 41, 1065-74(1927).—Partially correcting the conclusions of his first paper (cf. C. A. 21, 2901), M. finds that the products obtained are not derivs. of the 1,2,4,5-tetrazine. The compds. formed in the action of aromatic amines on hydrazodithiocarbamide and its monoaryl derivs. are derivs. of 1,2,4-triazole. They are formed by elimination of a mol. of H_2S . All these compds., except the one m. 297-300° and the one m. 272-3°, crystallize with 1 mol. H_2O , which can be eliminated by drying at 100°, or by a long stay in a desiccator. The 2 exceptions mentioned probably lose their water of crystn. during the drying in the air at room temp. All the compds. are acid. During the titration with an alkali, only 1 H can be replaced by the metal. The K salts are decompd. by CO_2 from the air. The original compds. are regenerated.

A. L. HENNE

Syntheses with azoimide and mechanism of the reactions. F. OLIVERI-MANDALÀ. *Mem. accad. Lincei* [vi], 2, 132-50(1926).—A summary is given of the syntheses effected by addn. of azoimide to compds. with 2 contiguous double linkings in the mol., such as carbodiphenylimide, carbimides and thioarbitimides, ketenes, CS_2 and HNO_2 , compds. contg. bivalent C, such as carbylamines and fulminic acid, the nitrilic linking, the ethylenic linking, and the acetylenic linking, the mechanism of the reaction being discussed in each case.

B. C. A.

Diazohydrates. L. CAMBI. *Atti accad. Lincei* [6], 5, 837-40(1927).—A discussion of the structure of diazohydrates, with special reference to a recent paper by Angeli (C. A. 20, 2991), which is considered epoch-making. The formula $RN(:O)NH$ is most probably that of normal diazohydrates and represents the product which results from the action of excess alkali on diazonium salts, and which can be converted in turn into the corresponding isodiazohydrates. The latter, which form addn. compds. with difficulty or not at all, are represented by the formula $RN:NOH$. No importance is attached to the objection of Hantzsch (C. A. 21, 1970) that the normal formula $RN(:O)NH$ of Angeli does not conform to the structure of the corresponding alkali salts, for the normal diazohydrates when transformed to the salts undergo simultaneously transformation to isodiazohydrates. The discussion leads to the conclusion that the structure of the alkali salts of normal diazohydrates, based on present opinion, is not in any way at variance with the structure of the corresponding free diazohydrates established by Angeli. The structure of the diazohydrates and their salts rests on chem. facts which the stereoisomerism described by Hantzsch neither foresees nor explains.

C. C. DAVIS

The two *p*-nitroazoxybenzenes. A. ANGELI AND D. BIGIARI. *Atti accad. Lincei* [6], 5, 819-23(1927).—Of all the pairs of derivs. of $PhN:N(:O)Ph$, the *p*-nitro derivs. $PhN N(:O)C_6H_4NO_2-p$ (I) and $PhN(O)NC_6H_4NO_2-p$ (II) are most alike in phys. and chem. properties, and they have been difficult to distinguish (cf. Angeli and Alessandri, C. A. 5, 3808). Br was used as a reagent in a new attempt to find a means of readily distinguishing them. I (1 g.) let stand 20 days with excess Br and a little Fe, the excess Br removed with $NaHSO_3$, filtered, the residue refluxed with EtOH, filtered when cold, the residue refluxed in EtOH suspension, cooled, decanted, again refluxed in fresh EtOH, cooled, filtered and recrystd. from C_6H_6 , gave approx. 0.70 g. of tribromo deriv., $C_{12}H_5O_3N_3Br_3$ (III), intense brilliant yellow, m. 206-8° to a brown-yellow liquid, which decomps. at 220°. It is also formed by brominating cold $BrC_6H_4N(:O)C_6H_4NO_2$. From the decanted alc. mother liquors seps. on chilling a flaky substance, which recrystd. from C_6H_6 , yields the compd. $C_{12}H_5O_3N_3$, greenish yellow, m. 150° to an orange liquid. It is doubtless II, formed directly from I. III (0.3 g.) refluxed with Sn (2 g.), concd. HCl (8 cc.) and AcOH (10 cc.) for 0.5 hr., evapd. to a small vol., water added, filtered, the residue recrystd. from ligroin, yields a probable mixt. of 2,4,6- $Br_3C_6H_2NH_2$ and 2,4- $Br_2C_6H_3NH_2$. The acid filtrate concd. after removal of Sn, made alk. with Na_2CO_3 , supersatd. with $(NH_4)_2SO_4$, extd. repeatedly with Et_2O , yields from the Et_2O ext. *p*-phenylenediamine. These reactions show that III is $Br_3C_6H_2N:N(O)C_6H_4NO_2$. Far different results were obtained when II was brominated. Following the same procedure as for I (loc. cit.) there were obtained from 10.8 g. of II after 20 days' standing about 10.7 g. of the compd. $C_{12}H_5O_3N_3Br$, yellow, m. 135-° to an orange-yellow liquid. Expts. to det. whether it is the same as the monobromo deriv. (m. 127°) described by Valori (C. A. 6, 2747) are not completed. The expts. show that I and II may be definitely distinguished by their behavior with Br under the particular conditions described. Expts. on the condensation of *p*- MeC_6H_4CHO (IV) with $PhNHOH$ which were recently described (C. A. 20, 2843) have since been found to have failed merely because the supposed IV was present only in a trace. $PhNHOH$ (1.09 g.) added to IV (1.20 g.) and the cryst. magma purified from EtOH and then from ligroin yields the nitrone *p*- $MeC_6H_4CH:N(:O)Ph$, m. 89-90° to a bright yellow liquid, decomps. 215°, forms IV when boiled with dil. H_2SO_4 , and when fused and recrystd. it changes slowly to the isomeric nitrone, *p*- $MeC_6H_4N(:O):CHPh$.

C. C. DAVIS

***p*-Arsonophenoxyacetic acid.** C. S. PALMER AND E. B. KESTER. *Org. Syntheses* 7, 45(1927).— $p-HOC_6H_4AsO_3H_2$ (218 g.) and 180 g. NaOH in 750 cc. H_2O , treated with 189 g. $ClCH_2CO_2H$ and the mixt. refluxed 4 hrs., then acidified with HCl, give 40-3% of *p*- $HO_2CCH_2OC_6H_4AsO_3H_2$.

C. J. WEST

Spectrochemical studies of hydroxyazo compounds. IV. TAKU UEMURA AND SHOZO TABEI. *Bull. Chem. Soc. Japan* 2, 229-36(1927); cf. C. A. 21, 1801.—Tautomeric transformations may occur when the neutral solns. of the tolueneazocresols are made alk. The dil. neutral solns. of these compds. is generally yellow and becomes deep yellow or orange when the soln. is alk. These tautomers are resp. given as the A (azo)- and R (red)-forms. There is one absorption band when the OH group

in the cresol ring takes the *p*-position with regard to the azo group, and 2 bands when it takes the *o*-position. The Me group has a hyperchromic influence, but when added to an already methylated compd., it ceases to be effective in the absorption curve. So far as the present study is concerned, the position of the Me group seems to have little influence.

A. L. HENNE

Isomers of *p*-hydroxy-3-aminophenylarsonic acid and its acetyl derivative (stovarsol). E. FOURNEAU, J. TREFOUEL, MME. J. TREFOUEL AND G. BENOIT. *Bull. soc. chim.* **41**, 499-514(1927).—2,6- $\text{H}_2\text{N}(\text{O}_2\text{N})\text{C}_6\text{H}_3\text{OH}$ is diazotized and treated with Na_2HASO_3 , giving 2-hydroxy-3-nitro-1-phenylarsonic acid, which was reduced to the 3-amino deriv. by NaHSO_3 and in turn acetylated to the 3-acetyl amino deriv. 3-Hydroxy-5-nitrophenylarsonic acid was prepd. similarly from $\text{O}_2\text{N}(\text{H}_2\text{N})\text{C}_6\text{H}_3\text{OH}$ and reduced in FeSO_4 soln. to the 5-amino deriv. Aminobenzoxazolone was diazotized and treated with Na_2HASO_3 to form benzoxazolonearsonic acid, which was nitrated to nitrobenzoxazolonearsonic acid. Diazotization of 6,2- $\text{O}_2\text{N}(\text{H}_2\text{N})\text{C}_6\text{H}_3\text{OH}$ and treatment with Na_2HASO_3 gave 2-hydroxy-6-nitrophenylarsonic acid, which was reduced to the 6-amino deriv. and this acetylated to the acetyl amino deriv. Some other facts concerning methods of prepn. and properties of other isomers of these acids are given, including 3-hydroxy-2-amino, 4-hydroxy-2-amino, 5-hydroxy-2-amino, 4-hydroxy-3-amino, 6-hydroxy-3-amino, 2-hydroxy-4-amino and 3-hydroxy-4-aminophenylarsonic acids.

R. C. ROBERTS

Triphenylstibine. G. S. HUIERS. *Org. Syntheses* **7**, 80-2(1927).—The PhMgBr from 40 g. Mg, 260 g. PhBr and 800 cc. Et_2O , treated with 114 g. SbCl_3 in 300 cc. Et_2O , gives 82-90% of crude Ph_3Sb .

C. J. WEST

The isomerism of *p*-hydroxyphenylarsonic acid. G. GILTA. *Compt. rend.* **184**, 1073-5(1927).—The diazotization of $p\text{-H}_2\text{NC}_6\text{H}_4\text{AsO}_3\text{H}_2$, with heating of the diazonium compd., and the arsenical fusion of PhOH give isomeric substances (I and II, resp.), the compd. being isolated in each case without passing through the salt. Possibly 1 substance is $p\text{-HOC}_6\text{H}_4\text{AsO}(\text{OH})_2$ and the other is $p\text{-O-C}_6\text{H}_4\text{As}(\text{OH})_2$. I is monoclinic and has $\beta = 92^\circ 17'$ and $a:b:c = 0.4483:1:0.4936$; II also is monoclinic and has $\beta = 91^\circ 4'$ and $a:b:c = 2.4652:1:0.7968$. II changes slowly into I. I gives a monoclinic Ba salt (III), having $\beta = 93^\circ 34'$ and $a:b:c = 1.0535:1:1.1766$; II gives an orthorhombic Ba salt (IV) having $\beta = 90^\circ$ and $a:b:c = 1.4881:1:1.1014$. III changes into IV. Nitration of I gives a NO_2 deriv. (V), large yellow triclinic crystals; nitration of II gives a NO_2 deriv. (VI), fine white needles; either V or VI is 3,4-(NO_2)(HO) $\text{C}_6\text{H}_3\text{AsO}_3\text{H}_2$. Dinitration of I and II and nitration of V and VI give 3,5,4-(NO_2)(HO) $\text{C}_6\text{H}_2\text{AsO}_3\text{H}_2$, which is monoclinic and has $\beta = 113^\circ$ and $a:b:c = 1.8272:1:1.6728$. I (II) and V (VI) are used in the manufacture of therapeutic compds., which probably are obtained, therefore, in isomeric forms. The proportions of these may influence the chemotherapeutic index. 3,4-Me(OH) $\text{C}_6\text{H}_3\text{AsO}_3\text{H}_2$ also has an isomeric form.

MARGARET W. MCPHERSON

*** Oxidizing action of chloramine-T.** G. SCHIEMANN AND P. NOVAK. *Z. angew. Chem.* **40**, 1032-3(1927).—Oxidation with chloramine-T (I) in acid soln. proceeds similarly as with acidified hypochlorite solns. Oxidation in aq. soln. in the absence of acids or alkalis occurs by virtue of the O_2 liberated by the action of water on I; an initial splitting of NaOCl need not be assumed. I in aq. soln. oxidizes phenanthrenequinone dioxime to the monoxime, and alcs. to the corresponding aldehydes without further oxidation to the corresponding acids. In alk. soln. NaOCl splits off from I, and this soln. therefore has a similar oxidizing action to that of a hypochlorite soln. of like concn. Alk. soln. of I oxidizes benzil dioxime smoothly to diphenylfuroxan.

F. C. H.

***p*-Chloromercuribenzoic acid.** F. C. WHITMORE AND GLADYS E. WOODWARD. *Org. Syntheses* **7**, 18-9(1927).—Crude $p\text{-MeC}_6\text{H}_4\text{HgCl}$ (500 g.), oxidized with 720 g. KMnO_4 and 1200 g. NaOH in 18 l. H_2O give 61-74% of crude $p\text{-ClHgC}_6\text{H}_4\text{CO}_2\text{H}$.

C. J. WEST

Anhydro-2-hydroxymercuri-3-nitrobenzoic acid. F. C. WHITMORE, P. J. CULHANE AND H. T. NEHR. *Org. Syntheses* **7**, 1-3(1927).—3-Nitrophthalic acid (211 g.) in 80 g. NaOH and 800 cc. H_2O , treated with 350 g. $\text{Hg}(\text{OAc})_2$ in 50 cc. AcOH and 700 cc. H_2O , heated at $165\text{--}75^\circ$ for 70 hrs., gives 82-90% of anhydro-2-hydroxymercuri-3-nitrobenzoic acid, cream-colored powder. By a similar procedure $\text{C}_6\text{H}_4(\text{CO}_2)_2\text{O}$ gives 85% of anhydro-*o*-hydroxymercuribenzoic acid.

C. J. WEST

Germanium. XVIII. Further organic compounds of germanium. W. R. ORNDORFF, D. L. TABERN AND L. M. DENNIS. *J. Am. Chem. Soc.* **49**, 2512-6(1927); cf. *C. A.* **21**, 540.— Ph_3GeBr is conveniently prepd. by warming Ph_3Ge and Br in $\text{C}_6\text{H}_6\text{Br}$ for a few min.; it m. 134° . Triphenylgermanium chloride, m. $117\text{--}8^\circ$, results from the oxide in dry petrol. ether satd. with HCl , by satg. a soln. of the bromide with HCl or from the oxide and concd. HCl in EtOH . The removal of 2 Ph groups from Ph_3Ge

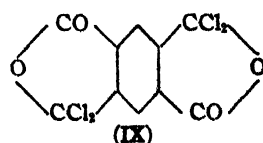
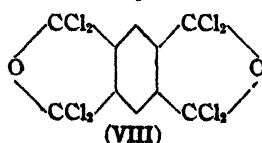
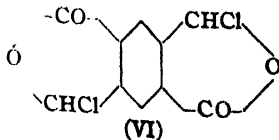
by Br does not proceed smoothly. Ph_3GeBr and a large excess of $p\text{-MeC}_6\text{H}_4\text{MgCl}$ give triphenyl- p -tolylgermanium, m. $123-4^\circ$. Ph_3GeBr and $p\text{-MeOC}_6\text{H}_4\text{MgBr}$ give triphenylanisylgermanium, m. $158-9^\circ$. Triphenylethylgermanium, m. $75-6^\circ$. Ph_3GeBr and PhNMe_2 do not react; with $p\text{-BrC}_6\text{H}_4\text{NMe}_2$ there results triphenyldimethyl-anilino-germanium, m. $140-1^\circ$; HCl salt, m. $105-10^\circ$ (decompn.). GeCl_4 and PhCH_2MgCl in C_6H_6 give tetra- p -benzylgermanium, m. $107-8^\circ$; soln. in an excess of 25% fuming H_2SO_4 below 35° gives the tetrasulfonic acid, analyzed as the Ba salt. GeCl_4 and Ph_2Hg in C_6H_6 at 140° for 2 days give phenylgermanic acid anhydride, amorphous; the p -tolyl, benzyl and dimethylaminophenyl derivs. were also prepd. Tetra- p -butylgermanium, b₇₃₃ $178-80^\circ$. C. J. WEST

The law of the direct formation of free chlorides by the action of PCl_5 upon phenol-hydroxy-substituted phenol- o -sulfonic acids. RICHARD ANSCHÜTZ AND THEODOR CURTIN. *Ann.* 457, 256-67 (1927).— p -Cresol-6-nitro-2-sulfonic acid (I), yellow, crystg. with $1.5\text{H}_2\text{O}$, m. 84° or, anhydrous, m. 172° ; the following salts were prepd.: NH_4 , golden yellow; Na, yellowish red; K, red needles; Ag, yellow needles; Mg, reddish yellow, with $5\text{H}_2\text{O}$; Ba, carmine-red, with $2\text{H}_2\text{O}$; Ni, dark green, with $5\text{H}_2\text{O}$; Co, red with $6\text{H}_2\text{O}$ or bluish violet if anhydrous. The acid (15 g.) with 15 g. PCl_5 , gently warmed, gives the chloride, yellow, m. $86-7^\circ$; amide, yellowish brown, sinters 205° , decomp. 210° ; anilide, yellow, m. 217° ; p -toluidide, yellow, m. 226° . The acid with excess SOCl_2 gives the anhydride, yellow, m. $158-9^\circ$. AcCl or Ac_2O and the free acid give a resinous mass; but the Na salt and Ac_2O give the Na salt of the p -Ac deriv., which, heated 8 hrs. with PCl_5 , gives p -acetylcresol-6-nitro-2-sulfonyl chloride (II), light yellow, m. 101.5° , also obtained by heating the above chloride with Ac_2O at 120° ; anilide, light yellow, m. 141.5° ; p -toluidide, light yellow, m. 113° . I (10 g.) and 20 g. POCl_3 at $75-80^\circ$ give 1.7 g. 6,6-dinitro-4,4-dimethylphenylene- o -sulfonylchloride, yellowish red, m. 84.5° ; this results in 0.45 g. from II and NH_3 in Et_2O or PhNEt_2 . p -Cresol-2,6-disulfonic acid crysts. with $2\text{H}_2\text{O}$, the anhydrous acid m. 145° ; Ag salt. PCl_5 gives the chloride, which reacts with Ac_2O to give the Ac deriv., m. 116° . p -Cresol-2,6-disulfanilide, m. 231° ; p -toluidide, m. 221° . p -Methylphenylene- o -sulfonylchloride- o , o -disulfanilide, pale red, m. $262-3^\circ$; the p -toluidide, m. $258-9^\circ$. Thus the 2 acids give with PCl_5 the free chloride without the PCl_5 reacting on the phenol hydroxyl. C. J. WEST

Action of potassium carbonate on certain phenyl alkyl ethers. L. C. RAIFFORD AND D. M. BIROSEL. *Proc. Iowa Acad. Sci.* 33, 175 (1926).—An abstract. When a ligroin soln. of Ph isopropyl, isobutyl or isoamyl ether was shaken with dry K_2CO_3 , cryst. products were obtained that were readily sol. in H_2O to give alk. liquids. When dil. acid was used, the corresponding ether was set free. The analyses of these products indicated that 1 at. wt. of K is combined with 2 mol. proportions of ether. So far, no such combinations have been obtained with Li_2CO_3 or Na_2CO_3 . Tests will be made with Rb_2CO_3 and Cs_2CO_3 later. W. G. GAESSLER

p -Dimethylaminobenzophenone. CHARLES D. HURD AND CARL N. WEBB. *Org. Syntheses* 7, 24-6 (1927).— PhNHBz (500 g.), 1025 g. PhNMe_2 and 525 g. POCl_3 give 72% of $p\text{-Me}_2\text{NC}_6\text{H}_4\text{Bz}$; full details of the prepn. are given. C. J. WEST

Derivatives of cumidic and pyromellitic acids. II. HENRI DE DIESBACH AND MARCEL GUHL. *Helv. Chim. Acta* 10, 442-9 (1927); cf. *C. A.* 20, 379.—On passing Cl_2 into the molten acid chloride (I) of β -cumidinic acid (II) (prepd. by action of PCl_5 on 5 g. II) at 150° , toward the end $180-90^\circ$, until there is an increase of 5 g. in wt., there is formed 1,4,2,5- $(\text{CHCl}_2)_2\text{C}_6\text{H}_2(\text{COCl})_2$ (III), m. $110-11^\circ$. By the action of 100% formic acid on III, there is formed 1,4,2,5- $(\text{CHCl}_2)_2\text{C}_6\text{H}_2(\text{CO}_2\text{H})_2$ (IV), which decomp. without m. 270° ; di-Et ester (V), m. 127.5° . V heated to 190° gives off EtCl , forming VI, yellow, m. 263° . By passing Cl_2 into molten I at 150° , heating the resulting chloride with 100% formic acid, crystallizing from AcOH , 1,4,2,5- $(\text{CH}_2\text{Cl})_2\text{C}_6\text{H}_2(\text{CO}_2\text{H})_2$ (VII), is formed which decomp. without m. 325° . Di-Et ester of VII



m. 132° with evolution of EtCl , forming p -pyromellitide. Continued chlorination of I at 265° leads to VIII, m. $267-8^\circ$, which can be crystd. from EtOH without the formation of EtCl , and from AcOH or HCO_2H unchanged. Temp. of chlorination higher than 265° leads to elimination of CO groups. Heating of either p - or m -pyromellitide with PCl_5 at $200-210^\circ$ gives VIII. IX is obtained by heating the normal chloride (X)

of pyromellitic acid with AlCl_3 at 100–110° for 3 hrs., m. 225–7°. Reduction of IX with AcOH and Zn gives *p*-pyromellitimide. D. and G. were able to obtain only two of the three diimides of pyromellitic acid described by H. Meyer and K. Steiner (see C. A. 8, 2365). The normal diimide prepd. by passing dry NH_3 into a benzene soln. of X dissolves in caustic alkali soln., but not in Na_2CO_3 , and sublimes at 300° in vacuum. On passing dry NH_3 into benzene soln. of IX, there forms a ppt. sol. in H_2O . Acidification of the aq. soln. gives 1,4,2,5-(CONH_2)₂ $\cdot\text{C}_6\text{H}_2(\text{CO}_2\text{H})_2$, which when heated above 200° gives the normal diimide.

FREDERICK C. HAHN

Benzanilide. CARL N. WEBB. *Org. Syntheses* 7, 6–7(1927).—Detailed directions are given for the prepn. of PhNHBz from PhNH_2 and BzOH ; the yield of crude product is 80–4%; 20–14% are lost on recrystn.

C. J. WEST

Bromination of α -phenylcinnamic nitrile by the action of light. A. BERTHOUD AND G. NICOLET. *Helv. Chim. Acta* 10, 417–29(1927). The reversible reaction between Br and phenylcinnamic nitrile has been studied in the light and in the darkness. In the darkness the reactions in both directions proceed more slowly than was previously assumed. This is due to the fact that the older expts. were not carried out in complete darkness. The results pertaining to the photochem. reaction are in complete discord with those obtained by Plotnikow (*Lehrbuch der Photochemie*, p. 250). Considered independently of the reverse reaction, the velocity with which Br is added to the nitrile is expressed by the following equations: $d[A\cdot\text{Br}_2]/dt = k_1 I_0^{1/2} [\text{Br}_2]^{1/2}$ for weak absorptions, and $d[A\cdot\text{Br}_2]/dt = k_1 I_0^{1/2} [\text{Br}]$ for total absorption. The thermal coeff. equals 1.4. The photochem. decompn. of the dibromide occurs only in the presence of Br acting as an optical sensitizer. When a large excess of the nitrile is present, the velocity of the reaction is expressed by the following equations: $-d[A\cdot\text{Br}_2]/dt = k_2 I_0^{1/2} [A\cdot\text{Br}_2]/[A] \cdot [\text{Br}_2]^{1/2}$ for a weak absorption, and $-d[A\cdot\text{Br}_2]/dt = k_2 I_0^{1/2} [A\cdot\text{Br}_2]/[A]$ for total absorption. When a large excess of the nitrile is not present, the denominator $[A]$ in the preceding equations is to be replaced by $[A] + m[A\cdot\text{Br}_2]$. The thermal coeff. equals 1.96. The photochem. equil. is independent of the luminous intensity, and is given by the relation $([A] + m[A\cdot\text{Br}_2])[\text{Br}_2]/[A\cdot\text{Br}_2] = K'$, which becomes $[A][\text{Br}_2]/[A\cdot\text{Br}_2] = K$, when a large excess of the nitrile is present.

A. L. HENNE

***p*-Iodobenzoic acid.** F. C. WHITMORE AND GLADYS E. WOODWARD. *Org. Syntheses* 7, 58–9(1927).— $p\text{-ClHgC}_6\text{H}_4\text{CO}_2\text{H}$ (300 g.), slowly added to 150 g. I in 2.5 l. EtOH, give 72–81% of *p*- $\text{IC}_6\text{H}_4\text{CO}_2\text{H}$.

C. J. WEST

2-Bromo-3-nitrobenzoic acid. P. J. CULHANE. *Org. Syntheses* 7, 12–14(1927).—A gently boiling soln. of 50 g. NaOH in 1.5 l. H_2O is treated with 330 g. anhydro-2-hydroxymercuri-3-nitrobenzoic acid (I), the material heated to boiling, 85 cc. concd. HCl added, heating discontinued, 30 cc. AcOH added and then 103 g. NaBr and 160 g. Br in 150 cc. H_2O and the soln. heated to boiling 5 min. after the Br is added; there results 53–61% of 2,3- $\text{Br}(\text{O}_2\text{N})\text{C}_6\text{H}_3\text{CO}_2\text{H}$ (based on the 3-nitrophthalic used in the prepn. of I).

C. J. WEST

Beckmann rearrangement of salicylhydroxamic acid derivatives. A. W. SCOTT AND J. H. MOTE. *J. Am. Chem. Soc.* 49, 2545–9(1927).—Salicylhydroxamic acid gives an *Ac* deriv., m. 142° (K salt, decomp. 85°) and a *Bz* deriv., m. 153° (K salt, decomp. 81°). Upon undergoing the Beckmann rearrangement these salts gave hydroxycarbanil instead of a *sym*-disubstituted urea; thus isocyanate is not formed or at least only momentarily.

C. J. WEST

New derivatives of vanillin. G. C. HILMAN AND O. H. ALDERKS. *Proc. Iowa Acad. Sci.* 33, 175(1926).—An abstract. Monobromovanillin was prepd. by Carles (*Bull. soc. chim.* 17, 12(1872)) and further investigated by Tiemann and Haarmann (*Ber.* 7, 615(1874)). More recently, Brady and Dunn (*C. A.* 10, 754) studied the corresponding oxime, which was found to exist in but 1 of the stereoisomeric forms required by the theory. In the present work a dibromo deriv. of vanillin, which has not hitherto been reported, has been prepd. by a method that gives a high yield. The oxime exists in but one form, and the nitrile obtained from it resists hydrolysis to an extraordinary degree. The detn. of the structure of the dibromo compd. is in progress.

W. G. GAESSLER

Reaction of *p*-substituted benzyl chlorides with sodium hydrogen sulfide. CHARLES BARKENBUS, E. B. FRIEDMAN AND R. K. FLEGE. *J. Am. Chem. Soc.* 49, 2549–53(1927).—2-Mercapto-4-methyl-6-hydroxypyrimidine (75 g.) and 12.14 g. Na in 750 cc. abs. EtOH, treated with 80.4 g. *p*- $\text{CNC}_6\text{H}_4\text{CH}_2\text{Cl}$ and heated until the reaction was neutral, gave 86.5% of the 2 *p*-cyanobenzylmercapto deriv., m. 240–1°; hydrolysis with about 10 parts 6 N HCl gives 86% of *p*-cyanobenzyl mercaptan (I), b. 135–8°, m. 37°, having a characteristic garlic odor. I (5 g.) and 5 g. *p*- $\text{NCC}_6\text{H}_4\text{CH}_2\text{Cl}$ in EtONa, re-

fluxed 4 hrs., give 67.7% of *p*-cyanobenzyl sulfide, m. 115°. I (5 g.) and 25 cc. concd. NH_4OH in 100 cc. 95% EtOH give 70.4% of *p*-cyanobenzyl disulfide, light yellow, m. 148°. *p*- $\text{NCC}_6\text{H}_4\text{CH}_2\text{Cl}$ and NaHS give a mixt. of the sulfide and disulfide; if a non-oxidizing atm. is used, only a very small amt. of the mercaptan is formed, the main product being the sulfide. NaSH and *p*- $\text{EtO}_2\text{CC}_6\text{H}_4\text{CH}_2\text{Cl}$ give a mixt. of the mercaptan (impure) and the sulfide, m. 78°. Sapon. of I by boiling with concd. HCl for 3 hrs. gives 89% of *p*-carboxybenzyl mercaptan, m. 176°. *p*-Carboxybenzyl mercaptan, b. 140–1° (74.2% yield). Negative groups such as the NO_2 , CN and CO_2Et in the *p*-position of substituted PhCH_2Cl favor the formation of the sulfide, while the positive Cl favors the formation of the mercaptan.

C. J. WEST

β -Bromoethylphthalimide. P. L. SALZBERG AND J. V. SUPNIEWSKI. *Org. Syntheses* 7, 8–10(1927).— $\text{C}_6\text{H}_4(\text{CO})_2\text{NK}$ is obtained in 79–89% yields from $\text{C}_6\text{H}_4(\text{CO})_2\text{NH}$ and KOH in EtOH; with $(\text{CH}_2\text{Br})_2$ this gives 69–79% of crude $\text{C}_6\text{H}_4(\text{CO})_2\text{NCH}_2\text{CH}_2\text{Br}$.

C. J. WEST

Ethyl phthalimidomalonate. A. E. OSTERBERG. *Org. Syntheses* 7, 78–9(1927).— $\text{C}_6\text{H}_4(\text{CO})_2\text{NK}$ (165 g.) and 210 g. $\text{BrCH}(\text{CO}_2\text{Et})_2$, heated if necessary to initiate the reaction and finally 1 hr. at 110°, give 67–71% of $\text{C}_6\text{H}_4(\text{CO})_2\text{NCH}(\text{CO}_2\text{Et})_2$.

C. J. WEST

3-Nitrophthalic anhydride. B. H. NICOLET. *Org. Syntheses* 7, 74–5(1927).—3-Nitrophthalic acid (211 g.), gently boiled with 205 g. Ac_2O until soln. results and then for 10 min. longer, gives 88.93% of the anhydride.

C. J. WEST

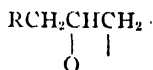
3-Nitrophthalic acid. P. J. CULHANE AND GLADYS E. WOODWARD. *Org. Syntheses* 7, 70–2(1927).—Tech. $\text{C}_6\text{H}_4(\text{CO})_2\text{O}$ (500 g.) and 650 g. com. H_2SO_4 (d. 1.84), heated to 80°, are treated with 210 cc. fuming HNO_3 (d. 1.51) (temp. 100–100°) and then with 900 cc. concd. HNO_3 , the ppt. of 3- and 4- NO_2 acids is extd. with 200 cc. H_2O and the residue dissolved in 200–300 cc. H_2O , from which crysts. 28–31% of the 3- NO_2 acid.

C. J. WEST

Rearrangement of some ethylenic oxides of general formula $\text{Ph}(\text{CH}_2)_n\text{CHCH}_2\text{O}$.

JEANNE LEVY AND SFIRAS. *Compt. rend.* 184, 1335–7(1927).—I. and S. studied the rearrangement of $\text{Ph}(\text{CH}_2)_n\text{CHCH}_2\text{O}$ to det. the affinitive capacities of the radicals

$\text{Ph}(\text{CH}_2)_n$ with respect to H. It is known that, in the rearrangement of an ethylenic oxide, a rupture occurs between O and the C holding the substituent whose affinitive capacity is the higher. In these cases the rupture occurred as follows: $\text{RCH}_2\text{CHCH}_2\text{O}$



$\text{RCH}_2\text{COCH}_3$. Therefore the affinitive capacities of PhCH_2 -,

$\text{Ph}(\text{CH}_2)_2$ -, $\text{Ph}(\text{CH}_2)_3$ - and $\text{Ph}(\text{CH}_2)_4$ - are lower than that of H. This conclusion, in the case of $\text{Ph}(\text{CH}_2)_2$ -, does not agree with the theory of alternate induced polarity. The homologous hydrocarbons, $\text{Ph}(\text{CH}_2)_n\text{CH}:\text{CH}_2$, were prepd. from $\text{CH}_2:\text{CHCH}_2\text{Br}$ and the Mg derivs. of PhBr , PhCH_2Br , $\text{Ph}(\text{CH}_2)_2\text{Br}$ and $\text{Pl}(\text{CH}_2)_3\text{Br}$. H_2O_2 and the hydrocarbons gave $\text{PhCH}_2\text{CHCH}_2\text{O}$ (I), $\text{Ph}(\text{CH}_2)_2\text{CHCH}_2\text{O}$ (II), $\text{Ph}(\text{CH}_2)_3\text{CHCH}_2\text{O}$ (III), and $\text{Ph}(\text{CH}_2)_4\text{CHCH}_2\text{O}$ (IV). I, II, III and IV are very stable; their rearrangement

is possible only in the presence of a catalyst. I, b₁₇ about 98–100°, gives 40% of a compd. whose semicarbazone, m. 183–4°, is identical with that of PhCH_2COMe . II, b₁₄ 106–9°, gives 30–40% of $\text{Ph}(\text{CH}_2)_2\text{Ac}$, b₂₆ 144–8°; semicarbazone, m. 141°; oxime, m. 88°. III, b₁₆ 122°, gives 35–8% of $\text{Ph}(\text{CH}_2)_3\text{Ac}$ (V), b₁₇ 132–5°, which was prepd. also by sapon. of the ester obtained from $\text{PhC}_2\text{H}_4\text{Br}$ and $\text{AcCH}_2\text{CO}_2\text{Et}$, with decompn. of the acid thus formed; semicarbazone of V obtained by either method, m. 127–8°; oxime, m. 52°. IV, b₁₆ 136–9°, d. 1.013, gives $\text{Ph}(\text{CH}_2)_4\text{Ac}$, b₁₇ 150–3°, which was prepd. also by the method given for V; semicarbazone, m. 136–7°. M. W. MCP.

Oxonium derivatives of carbopyrrotritaric acid. I. TREFILIEV AND A. AISENBERG. *Ukrainskii Khim. Zhurnal* 2, 173–81; *Chem. Zentr.* 1926, II, 2431; cf. *Ukrainskii Khim. Zhurnal* 1, 121.—I in Et₂O added to Na in AcOEt on the water bath and the product treated with 10% H_2SO_4 froms diethyl carbopyrrotritarate, $\text{C}(\text{CO}_2\text{Et})\text{CMe}:\text{O.CMe}:\text{C}(\text{CO}_2\text{Et})$ (I). With Br in CS_2 it forms an addn. compd., unstable bronze-colored crystals, and with I in CS_2 or in C_6H_6 it forms a dark cryst. compd., m. 102–3° (decompn.), very

unstable and contains more than 4 atoms of I per mol. Let stand 24 hrs. with aq. HCl (d. 1.2), I forms *monoethyl carbopyrrolitarate* (II), also formed by the action of concd. HBr. II is probably identical with the crystal compd. which remains after the spontaneous decompn. of the Br addn. compd. of I. With HI, II forms immediately the compd. $C_{12}H_{16}O_6 \cdot 2HI$, dark green, m. $92-3^\circ$ (decompn.), fairly stable in the desiccator, gives a red-brown soln. in C_6H_6 . A fairly stable Br deriv. of I is formed by the action of Br in aq. HBr on I.

C. C. DAVIS

Action on tyrosine and on phenylaminoacetic acid of acetic anhydride and acetone in the presence of pyridine. P. A. LEVENE AND ROBERT E. STEIGER. *J. Biol. Chem.* **74**, 689-93 (1927).—The action of a mixt. of commercial Ac_2O and C_6H_5N (without or with Me_2CO) gives a compd. $C_{14}H_{17}O_4N$, m. $122-3^\circ$, which may be $AcOC_6H_4CH_2CH(N:CMc_2)CO_2H$; the Me_2CO which apparently reacted with the NH_2 group may have been present in the Ac_2O or else formed in the course of the reaction. With 0.66N NaOH the compd. splits off the Ac group, giving the compd. $C_{12}H_{15}O_3N$, m. $163-6^\circ$. $PhCH(NH_2)CO_2H$, similarly treated, gives the compd. $C_{11}H_{13}O_3N$, m. $100-1^\circ$; in this prepn., CO_2 was evolved, so that the 2 formulas, $PhCH_2NAC_2$ and $PhCH(NHAc)Ac$, may be considered for this compd.

C. J. WEST

Benzoylpyruvic ester. H. GAULT AND A. FUNKE. *Bull. soc. chim.* **41**, 473-99 (1927).—Et benzoylpyruvate (I), m. 46° , was prepd. by condensing $PhCOMe$ with $(CO_2Et)_2$ in the presence of NaOEt. Condensation of I with HCHO in presence of NH_4Et in alc. or without solvent gave *Et methylenedibenzoylpyruvate* (II), in the form of a monohydrate, m. 95° , which decompd. when dehydrated. II gave a *diphenylhydrazone*, m. 100° and an *oxime* but no semicarbazone. Sapon. with alkalis or acids decompd. II, forming diphenylpentanedione, m. 62° , $H_2C_2O_4$, and EtOH, proving the constitution of II. Concd. H_2SO_4 removes 2 moles of H_2O from II, giving *methylenebisindonecarboxylic acid*, (IV), m. 170° . IV is unaffected by HCl and alkalis but is oxidized by $KMnO_4$ or $K_2Cr_2O_7$ to $o-C_6H_4(CO_2H)_2$ (V), thus proving its structure. HI does not reduce IV but Na-Hg gives a hydrogenated product, which can be oxidized to IV by HNO_3 . $SOCl_2$ failed to give the acid chloride of IV but a *sodium salt* of IV was prepd. $PhNHNH_2$ gave a *monophenylhydrazone* of IV. The Et ester (VI) of IV was obtained from IV in alc. with HCl gas. Oxidation of this ester gave V. Treatment of II with H_2SO_4 also gave VI. $PhNHNH_2$ gave the *diphenylhydrazone* of VI, m. 150° . $MeCHO$ and I failed to condense either in alc. with Et_2NH or directly. In presence of HCl they condense giving *methylketoparacophenone*, m. 129° , which forms a *Cu salt*, an *anilide*, is unaffected by acids and decomposes in alk. to $MeCHO$, $PhCOMe$ and $H_2C_2O_4$. C_6H_5CHO and I do not condense in alc. but by direct combination give *hexylketoparacophenone*, m. 136° which forms a *Cu salt*, an *anilide*, m. 140° , is unaffected by acids and decomposes in alk. to $PhCOMe$, $C_6H_{13}CHO$ and $H_2C_2O_4$.

R. C. ROBERTS

Chaulmoogramidobenzoic acids and chaulmoogramamides. SIMEONA SANTIAGO AND A. P. WEST. *Philippine J. Sci.* **33**, 265-9 (1927); cf. Herrera-Batteke, *C. A.* **21**, 1449.—The following alkyl anilides were prepd. by heating chaulmoogramide with the corresponding amine: *N-butylchaulmoogramide* (37% yield), m. $100.0-2.5^\circ$; *N-isobutylchaulmoogramide* (45% yield), m. $94.5-99^\circ$; *p-chaulmoogramidobenzoic acid* (14% yield), m. $188-94^\circ$; *o-chaulmoogramidobenzoic acid* (33% yield), m. $80-100^\circ$.

DAVID DAVIDSON

Rearrangement of acid azides and hydroxamic acids of geometrical isomers. LAUDER W. JONES AND J. PHILIP MASON. *J. Am. Chem. Soc.* **49**, 2528-36 (1927).— $PhCH:CHCON_3$ (5 g.), m. 86° , heated in C_6H_6 just below the b. p., gives 3 g. $PhCH:CHNCO$, b. 107° ; the latter, heated in H_2O at 50° gives *syn-distyrylurea*, m. 214° , this also results by the rearrangement of the azide in H_2O ; the azide, heated with C_6H_6 to give the isocyanate and then treated with NH_3 , gives *monostyrylurea* (I), m. 143° . Allocinnamic acid yields an azide which suffered decompn. and rearrangement at room temp.; it gives I with NH_3 . *Crotonyl azide* is a clear liquid with a sharp odor; heated on the H_2O bath and then treated with NH_3 , it yields *isallyl urea*, m. 122° ; the same product was obtained from the azide of isocrotonic acid, which slowly decomp. at $25-8^\circ$. The *K salt* of $PhCH:CHCONHOBz$ rearranges in H_2O , gives a compd., m. 152° , which has not been identified. These results seem to indicate that during rearrangement the configurations of the styryl and isallyl radicals are changed and only the stable *trans* configuration appears in the ureas and undoubtedly, also, in the first products of rearrangement, the isocyanates.

C. J. WEST

α -Cyano- β -phenylacrylic acid. ARTHUR LAPWORTH AND WILSON BAKER. *Org. Syntheses* **7**, 20-2 (1927).— $ClCH_2CO_2H$ (250 g.), 375 g. cryst. Na_2CO_3 and 100 cc. H_2O are treated with 130 g. NaCN in 250 cc. H_2O , the cooled soln. is neutralized with HCl and diluted to 1 l.; 400 cc. of this soln. is added to 5 g. NaOH in 400 cc. H_2O , the soln.

warmed to 40° and treated with 100 g. BzH, giving 65-70% of PhCH:C(CN)CO₂H.

C. J. WEST

Synthesis of *o*-nitrocinnamic acid and the photochemical behavior of this acid. IOAN TANASESCU. *Bull. soc. chim.* **41**, 1074-7 (1927).—This new synthesis gives a 95% yield; 10 g. *o*-O₂NC₆H₄CHO, 15 g. Ac₂O and 5 g. anhydrous AcONa are refluxed at 190° for 16 hrs. After cooling, the mixt. is boiled for a few min. with a concd. Na₂CO₃ soln., then acidified with HCl. The *o*-nitrocinnamic acid (I) crysts. out in a high degree of purity. One recrystn. from alc. is sufficient. A soln. of I exposed to the sun's rays becomes red. The photochem. reaction is very active at the start, but stops rapidly. This is explained by the fact that the green and shorter radiations are responsible for the reaction; the red color of the reaction product (II) rapidly prevents their admission. II can be separated from I by means of its greater soly. in alc. and ether. It does not cryst., but yields a red solid, which becomes soft at about 110° and melts completely at 120°. It exhibits an acid character. Heated above its m. p., it evolves CO₂. It is sol. in concd. H₂SO₄, yielding a brown soln., whereas I yields a blue soln. in the same solvent. II is an isomer of I, and is believed to be *hydroxyisatogenic acid*, with the following formula: C₆H₄CH(OH)C(CO₂H):N(:O).

A. L. HENNE

Diphenic acid. E. H. HUNTRESS. *Org. Syntheses* **7**, 30-3 (1927).—*o*-H₂NC₆H₄CO₂H, diazotized in AcOH and added to a CuOH suspension in dil. NH₄OH, gives 46-57% of diphenic acid.

C. J. WEST

Reduction of benzophenone by magnesium amalgam. Correction. M. GOMBERG AND W. E. BACHMANN. *J. Am. Chem. Soc.* **49**, 2666 (1927); cf. *C. A.* **21**, 579.—That Ph₂CO is not reduced by amalgam that had been prepd. by heating together Mg and Hg is confirmed but a simple mixt. of Mg and Hg at room temp. reduces Ph₂CO. This difference is not as yet explained.

C. J. WEST

***N*-Alkylimines of benzophenone.** MARCEL SOMMELET. *Compt. rend.* **184**, 1338 9 (1927); cf. *C. A.* **20**, 3451.—From Ph₂CCl₂ and RNH₂ were prepd. alkylimines, Ph₂C: NMe (I) in aq. soln. and 4 others in dry C₆H₆N. I, *b*₂₀ 168.5°, m. 47-9°; Ph₂C:NEt (II), *b*_{21.5} 174.5°, m. 61-2°; Ph₂C:NCH₂CH:CH₂ (III), *b*₂₂ 187°, *d*₄²² 1.0475; Ph₂C:NCH(CH₂)₄CH₂ (IV), *b*₁₇ 209-10° *d*₄²¹ 1.0268; Ph₂C:NCH₂Ph (V), *d*₄² 1.0358.

I, II, IV and V give stable methiodides, which are hydrolyzed quant. upon boiling in alc.: Ph₂C:NRMeI + H₂O → Ph₂CO + RNHMe.HI. III has not yet been studied from this point of view.

MARGARET W. MCPHERSON

Ethylideneacetophenone (propenyl phenyl ketone) and β -methoxybutyrophenone. CHARLES DUFRAISSE AND MARCEL DEMONTVIGNIER. *Bull. soc. chim.* **41**, 843-50 (1927).—Condensation of PhCOMe, MeOH and MeCHO in the presence of NaOMe gave β -methoxybutyrophenone (I), *b*₈ 119-21°, *d*₄²⁰ 1.0349, *n*_D²⁰ 1.5168, with some unchanged PhCOMe and variable quantities of decompn. products. Treatment of I with ZnCl₂ gave ethylideneacetophenone (II), m. 20-1°, *b*₉ 111-2°, *d*₁₆ 1.0250, *n*_D¹⁵ 1.5626. Treatment of I with Br in CS₂ gave α,β -dibromobutyrophenone (III), m. 97-8°. II can also be prepd. by reducing III with Fe in alc. slightly acid with AcOH.

R. C. ROBERTS

Catalysts and activated magnesium in the preparation of Grignard reagents. HENRY GILMAN AND J. M. PETERSON. *Proc. Iowa Acad. Sci.* **33**, 173-4 (1926).—An abstract. Many RX compds. enter sluggishly into reaction with Mg in the prepn. of organomagnesium halides. Furthermore, it is actually impossible to form RMgX compds. from some RX compds. Accordingly, a study is in progress on catalysts and activated Mg in order to extend the prepn. of Grignard reagents. The results so far obtained show that when an alloy contg. 12.75% Cu and the remainder Mg is heated in an evacuated tube at 200° for 1 hr. with about 0.5 its wt. of I, the activated alloy thus obtained is superior to that described by Bayer and used so extensively at present. It has been used in a study of the polarity of polyhalogen compds. and the yields of *p*-C₆H₄(MgBr)₂ from *p*-C₆H₄Br₂ are in excess of those obtained by the use of any activated Mg hitherto obtained. The same principle is being successfully employed in the study of organometallic compds. of Be, Ca, Sr and Ba.

W. G. GAESSLER

Problem of ring closure in addition compounds. III. Determination of the configuration of stereoisomeric hydrazones. WALTER HIEBER AND FRITZ SONNEKALB. *Ann.* **456**, 86-110 (1927); cf. *C. A.* **20**, 3251.—Two mol. α -benzilozone (I) in CHCl₃, treated dropwise with 1 mol. SnCl₄ in CHCl₃ gives the dark yellow, non-hygroscopic compd. SnCl₄.I, 2I, decomp. about 145°. Equimol. amts. of I and SnCl₄ give the compd. SnCl₄.I, brick-red powder, m. about 120°; on diln. the concd. red soln. becomes yellow (dissoecn.). Equimol. amts. of the β -osazone (II) and SnCl₄ in CHCl₃ give the bright

red, slightly hygroscopic *compd.* $\text{SnCl}_4 \cdot \text{II}$, m. about 60° ; this is more sol. in indifferent org. compds. than the α -isomer. On the basis of these observations I is considered to be the *syn*-, II the *anti*-form. $\text{SnCl}_4 \cdot 2$ benzalphenylhydrazone, yellow-brown, m. $70-5^\circ$ (decompn.). $\text{SnCl}_4 \cdot 2$ benzophenone phenylhydrazone, red, m. 190° . $\text{SnCl}_4 \cdot 2$ benzalanil, canary-yellow, m. 200° . $\text{SnCl}_4 \cdot \text{benzophenone anil}$, light yellow, m. 180° . $\text{SnCl}_4 \cdot \text{benzil dianil}$, golden yellow, m. 225° ; further addn. of SnCl_4 gives the $2\text{SnCl}_4 \cdot \text{dianil}$, yellow; a red *compd.*, probably $3\text{SnCl}_4 \cdot 2$ dianil, is also formed but was not analyzed. $\text{SnCl}_4 \cdot \text{benzil monoanil}$, light orange, m. 175° ; a red addn. product, $3\text{SnCl}_4 \cdot 2$ benzil monoanil, m. 90° , was also obtained. $\text{SnCl}_4 \cdot \text{benzil monophenylhydrazone}$, brownish red, m. 165° . $\text{SnCl}_4 \cdot \text{tetraphenylpyrazine}$, yellow, decomp. 135° ; with 2 mol. SnCl_4 , the *compd.* $2\text{SnCl}_4 \cdot \text{tetraphenylhydrazine}$, deep red, results. $\text{SnCl}_4 \cdot 2$ diphenyldihydropyrazine, pale yellow, m. 75° . $\text{SnCl}_4 \cdot \text{diphenyldihydropyrazine}$, light orange, m. $115-20^\circ$ (decompn.). Mol. wt. detns. on certain of these compds. are reported. C. J. WEST

Reduction of benzil by the binary system, magnesium + magnesium iodide (or bromide). M. GOMBERG and W. E. BACHMANN. *J. Am. Chem. Soc.* **49**, 2584-92 (1927); cf. *C. A.* **21**, 579.— $(\text{PhC}:\text{O})_2$ in $\text{Et}_2\text{O}-\text{C}_6\text{H}_6$ is reduced by the binary systems, $\text{Mg}-\text{MgI}_2$ and $\text{Mg}-\text{MgBr}_2$, quant. to the *halomagnesium salt* of stilbene diol, $(\text{PhC}(\text{OMgX})_2)_2$; with H_2O benzoin is produced; with acid chlorides esters result; Br and I yield benzil; with O 2 products are formed, benzil and a polymer of the anhydride of benzoic acid. Other binary systems [$\text{Be}-\text{BeI}_2$ (95% yield), $\text{Zn}-\text{ZnI}_2$ (71% yield), $\text{Mg}-\text{Hg}$ (72% yield)] also reduce benzil in a similar manner. The possible mechanism of the reduction is discussed. The reactions with aliphatic-aromatic ketones, aromatic aldehydes and esters towards the binary systems seem to be more complex, though in general of the same nature as described for the ketones. C. J. WEST

Substitution and addition. JAKOB MEISENHEIMER and WALTER SCHLICHENMAYER. *Ann.* **456**, 126-51 (1927).—M. seeks to consider the Walden rearrangement, the abnormal substitution of unsatd. alcs. and chlorides and the *trans*-addn. to C_2H_4 compds. from a general viewpoint. The original should be consulted for the discussion. $\text{Ph}_2\text{C}:\text{CHPh}$ and Br react vigorously in CHCl_3 or CS_2 with HBr evolution; the normal dibromide results only in CCl_4 , m. 95° (70% yield); the solid dibromide slowly decomp. but is stable under lignin. The decompn. in soln. is dependent upon the nature of the solvent; under comparative conditions 60% of the Br is split off in 0.5 hr. in AcOH, 55% in thiophene- C_6H_6 , 20% in ordinary C_6H_6 , 35% in CHCl_3 . From the C_6H_6 soln. there crysts. $\text{Ph}_2\text{C}:\text{CBrPh}$ and $\text{Ph}_2\text{C}:\text{CHPh}$; from EtOH, these 2 and also $\text{Ph}_2\text{C}:\text{C}(\text{OEt})\text{Ph}$, m. 135.5° . Triphenylbromoethylene, m. 115° , is best prepd. from 2 g. $\text{Ph}_2\text{C}:\text{CHPh}$, 0.4 g. Br and 5 cc. CS_2 (yield, 2 g.); with Cl it gives triphenyltrichloroethane, m. 124° . $\text{Ph}_2\text{C}:\text{CPhMe}$ and Br in CCl_4 give triphenylbromopropene, m. 122° ; oxidation gives Ph_2CO and BzCH_2Br ; Br gives 1,1,2-triphenyl-3,3-dibromo-1-propene, yellow, m. 129° , HBr splitting off and the *compd.* then m. 158° ; EtOH gives 1,1,2-triphenyl-3-ethoxy-1-propene, m. 129° , while PhMgBr gives 1,1,2,3-tetraphenyl-1-propene, m. $138-9^\circ$. C. J. WEST

A molecular rearrangement in the naphthylaminesulfonic acid series. A. WAHL and G. VERMEYLEN. *Bull. soc. chim.* **41**, 514-23 (1927).—1,8-Naphthylaminesulfonic acid is converted into its isomer naphthionic acid, when heated for a long time at 90° with concd. H_2SO_4 , the sulfonic group migrating from position 8 to 4. R. C. R.

Supposed isomerism of 9-methylfluoreno. HEINRICH WIELAND and JOSÉ CEREZO. *Ann.* **457**, 249-55 (1927).—The supposed isomer of 9-methylfluoreno (I), m. 84° (*C. A.* **19**, 2334) is now shown to be the *Et ether*; this is also prepd. from the chloride and EtONa. I and BzCl in $\text{C}_6\text{H}_5\text{N}$ give the *O-Bz deriv.*, m. 173° ; *O-Ac deriv.*, m. 75° ; in vacuum it loses AcOH; boiling with EtOH gives the *Et ether*. C. J. WEST

Anthraquinonesulfonic acids. H. E. FIERZ-DAVID. *Helv. Chim. Acta* **10**, 429 (1927); cf. *C. A.* **21**, 1811.—Reply to Wibaut, *C. A.* **21**, 2268. C. J. WEST

Halochromism and deep-colored ketones. R. WIZINGER. *Z. angew. Chem.* **40**, 939-45 (1927).—A review of the literature with 27 footnotes. In the halochromic colors of numerous deep-colored mono- and diketones (indanthrenes, indigo, etc.), the principal chromophore, as in the case of the dye salts, is a coordinated unsatd. central atom in the ionized state. Dilthey's chromophore theory and the new form of the auxochrome theory thus permits the assembling of these compds. into one group, which has not been possible heretofore. C. J. WEST

Relationship between the structure and the biological action of the cardiac glucosides. W. A. JACOBS and ALEX. HOFFMANN. *J. Biol. Chem.* **74**, 787-94 (1927).—Catalytic reduction of 3.5 g. of cymarin (I) gives 2.8 g. hydrocymarin (II), *crystg.* with 1 H_2O , m. 128° (effervescence) and then 190° , $[\alpha]_D^{25}$ 17.8° (c 1.11, $\text{C}_6\text{H}_5\text{N}$); it does not give the nitroprusside reaction; hydrolysis with $\text{MeOH}-\text{HCl}$ gives dihydromonoanhydro-

strophanthidin, m. 226°, $[\alpha]_D^{25}$ 48.5° (c 1.978, C_6H_5N); this also results from dihydrostrophanthidin and dil. MeOH-HCl. Catalytic reduction of ouabain (III) gives the *dihydro deriv.* (IV), amorphous, foams at 105°, $[\alpha]_D^{30}$ -47.4° (c 2.286 in H_2O). *Dihydrodigiloxin*, m. 202-4°, $[\alpha]_D^{25}$ 2.4° (c 0.622, C_6H_5N); on diln. of its EtOH soln. with H_2O it crystals too quickly to permit toxicity detns. The ratio of toxicity of I to II for frogs is 23.3:1, for III to IV, 16.1:1. Thus the biol. action of the cardiac glucosides belonging to the group of unsatd. lactones is a property apparently inherent in the mol. as a whole and the double bond alone does not det. the character but may contribute to the intensity of the action.

C. J. WEST
Constitution of the acids formed in the degradation of cholic acid. W. BORSCHKE. *Z. physiol. Chem.* 169, 306-7 (1927).—Polemical with Wieland (C. A. 21, 2905).

A. W. DOX

The bile acids. XVII. Martin Schenck and Henry Kirchhof. *Z. physiol. Chem.* 169, 164-76 (1927); cf. C. A. 21, 2477.—The ketolactammonocarboxylic acid, $C_{23}H_{43}NO_6$, obtained by vacuum distn. of the isoxime of desoxybilianic acid, when oxidized with $KMnO_4$, yields a *ketolactamdicarboxylic acid*, $C_{23}H_{43}NO_6$, m. 277° (decompn.), without opening of the heterocyclic ring. This reaction corresponds to the oxidation of pyrodesoxybilianic acid to the diketodicarboxylic acid. Bilisoidanic acid, the triketotricarboxylic acid obtained by oxidation of isobilianic acid with 32% HNO_3 , when warmed with dil. NaOH undergoes change from a tribasic to a tetrabasic acid, but on removal of the alkali with excess HCl the acid which seps. is again tribasic but not identical with the original bilisoidanic acid. The first change is believed to be a hydrolysis of 2 adjacent carbonyls into $:C(OH)CO_2H$, a sort of benzoic acid rearrangement, and a transformation of the 6-membered into a 5-membered ring; then when the free acid is liberated from its Na salt, ring closure occurs by lactone formation between a CO_2H and the newly formed OH. The final product is a *tribasic acid*, $C_{21}H_{39}O_8 + 2H_2O$, which sinters 230° and foams 248°. The intermediate tetrabasic γ -hydroxy acid is analogous to cilianic acid, which may conceivably result by benzoic acid rearrangement of an unknown intermediate triketotricarboxylic acid formed when bilianic acid is oxidized.

A. W. DOX

Furan. W. C. WILSON. *Org. Syntheses* 7, 40-1 (1927).—Crude furan-2-carboxylic acid (about 95% pure), heated at 200-5°, gives 72.8% of furan, b_{745} 31-4°. C. J. W.

2-Furylmethyl acetate (furfuryl acetate). MINER LABORATORIES. *Org. Syntheses* 7, 44-5 (1927).—2-Furylcarbinol (600 g.), 225 g. $AcONa$, 650 g. Ac_2O and 1 l. C_6H_6 , heated 4 hrs., give 87.93% of furfuryl acetate.

C. J. WEST

Furfuralacetone. G. J. LEUCK AND L. CEJKA. *Org. Syntheses* 7, 42-3 (1927).—Furfural and Me_2CO , condensed with 33% NaOH at 10°, give 60-6% of furfuralacetone, m. 37.9°.

C. J. WEST

Diphenylthiophene. EMIL FROMM, PAUL FANTL AND EPHRAIM LEIBSOHN. *Ann.* 457, 267-77 (1927).—Steinkopf (C. A. 15, 2870) believed that the 2 diphenylthiophenes, m. 119° and 153°, were identical, because he obtained the same $HgCl_2$ deriv. from each. The following behavior of the 2 derivs. shows them to be 2 different compds. α,α' -Diphenylthiophene (I), m. 153°, obtained in 5-8 g. yield from $PhCH:CHCO_2H$ and S, yields 50% of a *tetrabromo deriv.*, m. 203°. α,β' -Diphenylthiophene (II), obtained in 2-4 g. yield from the same reaction, gives 50-60% of a *tetrabromo deriv.*, m. 150°, if the reaction is carried out in $CHCl_3$; if Br acts on dry II, a compd. m. 245° results, sol. only in CS_2 . I yields a *trinitro deriv.*, yellow, m. 243° (80% yield), while the mother liquors give a *dinitro deriv.*, yellow, m. 189°. II and concd. HNO_3 give a compd., m. 271°, which contains N but a higher S content than II. I gives a *picrate*, ruby red, m. 133-4°; I does not react with picric acid. I, $AcCl$ and $AlCl_3$ give a poor yield of α,α' -diphenylthiophene- β -methyl ketone, m. 214°; the corresponding deriv. from II m. 94°. I does not give a compd. with $HgCl_2$, while that from II, m. 222°. Likewise, I does not react with $Hg(OAc)_2$, while II gives the compd. $C_{16}H_{11}SHgO(OAc)$, m. 207-8°.

C. J. WEST

4-Hydroxypyrazoles and their tautomerism. ALFRED BERTHO AND HANS NUSSEL. *Ann.* 457, 278-307 (1927).— EtO_2CCHN_2 (11.4 g.) and 16 g. $CH_3(CO_2Et)_2$, treated during 2 hrs. with 48 g. $EtONa$, gives 25% of *di-Et 4-hydroxypyrazole-3,5-dicarboxylate*, m. 151°; it gives the enol reaction and a white *Ag salt*; heated with 10 parts 20% HCl 10 min. at 100°, it gives 4-hydroxypyrazole-5-carboxylic acid, m. 204°. Using MeOH in the condensation or heating the Et ester with MeONa gives the Me ester, m. 232°. Similarly EtO_2CCHN_2 and $PhCH(CO_2Et)_2$ with $EtONa$ give 17% of *Et 3-benzyl-4-hydroxypyrazole-5-carboxylate*, m. 169°; the *free acid*, m. 183.5° (decompn.), giving 3-benzyl-4-hydroxypyrazole, m. 157°. *Et 3-isoamyl-4-hydroxypyrazole 5-carboxylate*, m. 115° (42% yield); the *free acid*, m. 186° (decompn.), giving 3-isoamyl-4-hydroxypyrazole,

m. 85°. *Et 3-phenyl-4-hydroxypyrazole-5-carboxylate*, m. 162° (the yield is very small). $\text{EtO}_2\text{CCHN}_2$ and $\text{NCCH}_2\text{CO}_2\text{Et}$ with EtONa give 12% of *di-Et 4-aminopyrazole-3,5-dicarboxylate*, m. 144°; the diazotized ester with $\alpha\text{-C}_{10}\text{H}_7\text{OH}$ gives a red ppt., decomp. 210°. With 10% HCl it gives *4-aminopyrazole-5-carboxylic acid*, m. 212.5°, whose diazo soln. gives a dark red dye with $\alpha\text{-C}_{10}\text{H}_7\text{OH}$. Heated to 220°, the acid gives 4-aminopyrazole. From a study of the reaction of these derivs. it is shown that the esters, especially, are not only tautomeric substances but that in soln. they form an equil. mixt. of keto-enol desmotropes. C. J. Wessr

Comparison of heterocyclic systems with benzene. II. Reduction potentials of quinones containing the pyridine, imidazole, triazole and thiophene rings. L. F. FIESER AND M. A. AMES. *J. Am. Chem. Soc.* **49**, 2604-17 (1927); cf. *C. A.* **20**, 1623.—On comparing the reduction potentials of the quinones of the C_{10}H_8 and $\text{C}_{14}\text{H}_{10}$ series with quinones contg. the 2-phenyltriazole nucleus in place of 1 of the C_6H_4 rings, it is found that a striking similarity exists between this heterocyclic nucleus and C_6H_6 . The 1,2,3-triazole ring is similar to these other 2 and probably has the structure of the 2-Ph deriv., for a quinone contg. the 3-phenyltriazole grouping is much higher in potential than the corresponding triazolequinone or its 2-Ph deriv. The pyridine and imidazole nuclei do not produce a lowering in the potential of quinones to which they are attached which is at all comparable with the effect of a phenylene group. Heterocyclic analogs of anthraquinone do not have the same relation to this substance which the angular isomers bear to phenanthrenequinone. *2-Phenyl-4-amino-5-hydroxybenzotriazole-7-sulfonic acid*, cryst. with $1.5\text{H}_2\text{O}$, results from the 4-NO deriv. in NaHSO_3 soln. Oxidation with 25% HNO_3 gives *2-phenylbenzotriazole-4,5-quinone-7-sulfonic acid*, analyzed as the *K* salt, orange-yellow needles. The acid is decompd. by alkalis, and with concd. H_2SO_4 evolves SO_2 ; it is readily reduced by SO_2 and condenses with amines; *p*- $\text{MeC}_6\text{H}_4\text{NH}_2$ gives *2-phenyl-7-(p-toluidino)-benzotriazole-4,5-quinone*, dark red, m. 215°. *1-Phenyl-4-benzeneazo-5-hydroxybenzotriazole*, bright red, could not be reduced to the amine. α,β -*Naphthimidazole-4,5-quinone*, orange, does not m. 250°. The normal reduction potentials of a no. of quinones are tabulated. C. J. Wessr

Preparation of fisetol. P. KARRER AND H. BIEDERMANN. *Helv. Chim. Acta* **10**, 441 (1927).—In contradistinction with Sater and Stephen (*C. A.* **14**, 1966), the authors were unable to detect the formation of any 5-hydroxycoumarone as a by-product in the synthesis of fisetol. They report the exptl. details by which 12 g. fisetol, m. 189°, is obtained from 10.5 g. glycolic nitrile and 19.3 g. resorcinol. These 2 compds. are dissolved in 120 cc. abs. Et_2O with a trace of ZnCl_2 . The soln. is satd. with HCl gas, the imide hydrochloride filtered, washed with Et_2O , covered with H_2O , heated for 2 hrs. on the water bath, and allowed to crystallize. Fisetol is characterized by its phenylhydrazone, m. 107-9°. A. L. HENNE

Xanthydrol. A. F. HOLLEMAN. *Org. Syntheses* **7**, 88-9 (1927).—Xanthone is reduced by Na-Hg to xanthydrol, the yield being 91-5%. C. J. Wessr

Xanthone. A. F. HOLLEMAN. *Org. Syntheses* **7**, 84-6 (1927).—*o*- $\text{HOC}_6\text{H}_4\text{CO}_2\text{Ph}$ (500 g.), heated to 275-85° (at which point PhOH distills) and the heating so regulated that the temp. of the vapors never exceeds 175° (preferably below 170°), gives after 6-7 hrs. 220-25 g. PhOH ; further distn. gives 61-3% xanthone. C. J. Wessr

Differential cleavage of the carbon to carbon linkage by alkali metals. J. B. CONANT AND B. S. GARVEY, JR. *J. Am. Chem. Soc.* **49**, 2599-603 (1927).—The action of Na-K alloy, 40% Na-Hg and 1% Na-Ig on a no. of substituted dixanthyls and certain ethanes has been studied. By using these reagents in C_6H_6 or Et_2O one can differentiate between certain compds. which contain a reactive C-C linkage. The rate of cleavage by Na-K alloy is essentially the same for a no. of substituted dixanthyls and dixanthyl itself. This is probably due to the fact that with this powerful reagent a phys. process controls the rate of the heterogeneous reaction. Dimethyldixanthyl gives *methylxanthanoic acid*, m. 205.6°; *Me ester*, m. 96-7°. *Ethylxanthanoic acid*, m. 173-4°; *Bu deriv.*, m. 144.5° (*Me ester*, m. 73-4°); *benzyl deriv.*, m. 232° (*Me ester*, m. 103-4°). C. J. Wessr

Synthesis of β -acid (2,6-dihydroxyquinoline-4-carboxylic acid) obtained from "Roh-Oryzanin" by hydrolysis. YOSHIKAZU SAHASHI. *Proc. Imp. Acad.* **3**, 437-8 (1927).—The outline of the method of this synthesis is given; details will appear in *Biochem. Z.* C. J. Wessr

Unsymmetrical phenanthridones. II. New preparation method: 7-nitrophenanthridone by Beckmann rearrangement of 2-nitrofluorenone oxime. F. J. MOORE AND E. H. HUNTRESS. *J. Am. Chem. Soc.* **49**, 2618-24 (1927); cf. *C. A.* **21**, 1987.—Fluorenone oxime with PCl_5 undergoes a normal Beckmann rearrangement, yielding phenanthridone. Oximation of 2-nitrofluorenone yields mainly, if not entirely, 1 of

2 possible stereoisomers, m. 262.5–3°; Beckmann rearrangement gives 90% of 7-nitro-phenanthridone, a Cl product (an equil. between the oxime chloride and its rearrangement product?) being an intermediate step, which is converted into the desired NO₂ deriv. by boiling with PhCl, AcOH or 50% H₂SO₄. C. J. WEST

A new synthesis of the acridones. I. TANASESCU. *Bull. soc. chim.* **41**, 528–37 (1927).—The prolonged action of concd. H₂SO₄ on 2,4-(O₂N)₂C₆H₃CHO in C₆H₆ gave 2-nitro-5-keto-5,10-dihydroacridine (I) and an ether of dinitrobenzohydrol, m. 167°. Treatment of I with PhNMe₂ and POCl₃ gave 2-nitro-5-dimethylaminophenylacridine, m. 225°, which was identical with the product obtained from the acridine made by Ullman with the same reagents. Using PhCl, PhBr and PhMe, resp., in place of C₆H₆ above gave 2-nitro-5-keto-5,10-dihydro-8-chloroacridine, 2-nitro-5-keto-5,10-dihydro-8-bromoacridine and 2,4-dinitro phenyl-di-p-tolylmethane, m. 280° (decompn.). Reactions of this type are general ones and are explained by assuming that o-O₂NC₆H₄CHO exists in 2 tautomeric forms. These condensations are being studied further.

R. C. ROBERTS

Action of piperidine on various α-bromo-α,β-ethylenic ketones. CHARLES DUFRAISSE AND HENRI MOUREU. *Bull. soc. chim.* **41**, 850–62(1927).—Piperidine (I) reacts with α-bromoanisalacetophenone to give piperidinoanisalacetophenone, m. 75.5–6.5°. I and α-bromomesityl oxide or dibromomesityl oxide gave mesitylpiperidino oxide, b₁₀ 101°, n_D²⁰ 1.4710, d₄^{19.5} 0.9395. The dibromide of phenylvinyl ketone and I gave dipiperidinomethylacetophenone, m. 71–3°. I and the dibromide of ethylideneacetophenone gave dipiperidinoethylacetophenone, m. 113.5–4.5°, which is hydrolyzed by H₂SO₄ to propionylbenzoyl and α-piperidinoacetophenone. I and α-bromothylideneacetone gave a piperidine product which is hydrolyzed by H₂SO₄ to acetylpropionyl and piperidinoacetone. α-Bromobenzalacetophenone and alc. NH₃ gave α-amino-benzalacetophenone, m. 95–7°, which gives a hydrochloride, m. 184° and a hydrobromide, m. 189° and is hydrolyzed by acid to phenylglyoxal.

R. C. ROBERTS

β-Pyridyl-α-pyrrolidine (nornicotine). MAX AND MICHEL POLONOVSKI. *Compt. rend.* **184**, 1333–5(1927); cf. C. A. **21**, 1654.—Ac₂O and I, the N-oxide of nicotine, give acetylnornicotine (II), thick oil, α_D –13.6° (c 4.32%, C₆H₆). II gives with acids uncrystallizable acid salts, decomposed by H₂O; the picrate and the chloroaurate are oily. Bz₂O and I give benzoylnornicotine (III), thick oil. Sapon. of II or III gives nornicotine (IV), CH:CH.CH:N.CH:CCH(CH₂)₃NH. IV is a readily oxidizable oil,

b₁₀ 150–5°, α_D –20° (c 3.87%, MeOH). IV gives an oily NO deriv. and an oily urea deriv. IV gives neutral and acid salts, mostly uncrystallizable; picrate, yellow, m. 135°; the mono- and di-HCl salts are easily decompd. by heat; chloroaurate, m. 210–2° (decompn.).

MARGARET W. MCPHERSON

Quinazolines. XXXVIII. Synthesis of some new analogs of cinchophen and intermediate products. MARSTON TAYLOR BOGERT AND EUGENE MILLER MCCOLM. *J. Am. Chem. Soc.* **49**, 2650–4(1927); cf. C. A. **18**, 2900.—o-(o-Nitrobenzoylamino)acetophenone (I), m. 156° (78% yield); m-nitro deriv., m. 170° (78% yield); o-salicylaminoacetophenone, m. 135° (59% yield); o-(p-acetoxybenzoylamino)acetophenone, m. 97.5° (75% yield); hydrolysis gives the p-hydroxy deriv., m. 219° (90% yield). Oxidation of I with alk. KMnO₄ gives o-nitrobenzoylisatinic acid (II), which was not purified nor analyzed because of its instability; salicylisatinic acid, yellow, m. 209–10° (decompn.) (90% yield); p-hydroxybenzoylisatinic acid, m. 209–10°. Crude II and NH₃ in abs. MeOH heated at 140° for 10 hrs. give 2-(o-nitrophenyl)quinazoline-4-carboxylic acid, m. 235° (still not pure); the 2-(o-hydroxyphenyl) deriv., yellow, m. 171°; Et ester, yellow, m. 115°; the 2-(p-hydroxyphenyl) deriv., yellow, m. 251°; Et ester, yellow, m. 159°. The above m. ps. are cor.

C. J. WEST

Alkaloid trichloroacetates. Use of trichloroacetic acid in toxicology. G. FLORENCE. *Bull. soc. chim.* **41**, 1097–1100(1927).—CCl₃CO₂H should replace H₂SO₄ for the isolation of the alkaloids in a toxicological investigation, because H₂SO₄ is likely to destroy digitalin, cocaine and atropine. New trichloroacetates have been prepd. from several bases. In the following table, the org. base used, the number of H₂O mols. of crystn. and the soly. in H₂O at various temps. in % are recorded successively. Aniline, 1, S₅₅ = 33.21, S₁₅ = 3.28; o-toluidine, 1, S₅₄ = 43.3, S₁₅ = 7.2; p-toluidine, 1, S₅₇ = 38.4, S₁₅ = 2.7; strychnine, 3, S₅₅ = 20.75, S₁₅ = 4.03; brucine, 3, S₅₅ = 25.25, S₁₅ = 4.02; morphine, 3, —; codeine, 2, S_{54.5} = 23.71, S₁₅ = 2.81; quinine, 4, S₅₅ = 29.98, S₁₅ = 3.43; quindine, 3, —. The trichloroacetates of cocaine, nicotine, atropine and cinchonine are easily prepd., but it was impossible to obtain crystals. All the trichloroacetates are sol. in EtOH, Me₂CO, insol. in benzene or ligroin. Boiling H₂O has a tendency to cause the

evolution of CHCl_3 and CO_2 , together with the pptn. of the basic radical.

A. L. HENNE

Yohimbine. A. SCHOMER. *Arch. Pharm.* **265**, 509-24 (1927).—The present study embodies the main results obtained in an investigation on yohimbine (I) (Dissertation, Marburg, 1927). The initial material examd. was a sample of I-HCl "Gehe," the isolated base of which m. 231° and gave values on analysis agreeing fairly well with the formula $\text{C}_{20}\text{H}_{28}\text{O}_3\text{N}_2$, proposed by Spiegel (cf. *Ber.* **37**, 1904), although its HCl salt (as also the HBr and HI derivs.) more nearly corresponded to the compn. $\text{C}_{21}\text{H}_{28}\text{O}_3\text{N}_2$, corroborative evidence of which has also been furnished by Ellen Stedmann (cf. *C. A.* **21**, 2133). Of the three O atoms in I 2 are believed to function as a methylated carboxyl group, the 3rd as hydroxyl, which latter cannot, however, be phenolic in character because of the insoly. of I in aq. alkali. Since I yields with Ac_2O and AcONa a cryst. *di-Ac deriv.*, m. 183° , and an amorphous *mono-Ac deriv.*, m. 150° , it follows that in the former a secondary N atom must be engaged. Solns. of the amorphous deriv. show green fluorescence; they yield no cryst. salts except an aurate. Attempts to split the I ring by oxidation, reduction, exhaustive methylation *via* Hofmann, treatment with CNBr , etc., all gave negative results. The behavior of I toward CNBr points to the presence of a tetrahydroquinoline ring in the mol. Reduction of I in abs. alc. soln. with Na, in accordance with the expression $\text{C}_{19}\text{H}_{23}\text{ON}_2 \cdot \text{CO}_2\text{CH}_3 \rightarrow \text{C}_{19}\text{H}_{23}\text{ON}_2 \cdot \text{CH}_2\text{OH}$, gave *yohimbyl alcohol*, crystg. with 2 mol. of H_2O and m. 148.9° (202° after loss of H_2O by drying at 105°); *HCl salt*, $\text{C}_{20}\text{H}_{28}\text{O}_2\text{N}_2 \cdot \text{HCl}$, $[\alpha]_D^{20}$ 37.5° (1 g.:50 cc. $\alpha_D = 0.75^\circ$ (1-dm. tube)); *methiodide*, m. 215° .

W. O. E.

New dyes derived from acenaphthene (TARPEY) **25**. Certain amino derivatives of acridine and some related compounds (MEEKER) **25**. The thermochemistry of organic compounds (BERNER) **2**. Isolation of the natural oxidation inhibitors of crude Hevea rubber (BRUSON, *et al.*) **30**. Furan compounds derived from sugars (KARASHIMA) **11A**. Vapor pressures of diphenyl and of aniline (GARRICK) **2**. The rate of racemization of pinene (SMITH) **2**. The physical properties of some cyclohexane derivatives (NAGORNOV, ROTINYANTZ) **2**. The decomposition of some organic substances by the electric spark (FOWLER, MARDLES) **2**. The chemistry of Sanguis Draconis (FRANKEL, DAVID) **17**. New syntheses in the solvent industry (VOSS) **13**. The preparation of vital neutral red (PHILLIPS, COHEN) **11B**. The equilibria of tetranitromethylaniline in certain binary systems (IFREMOV, TIKHOMIROVA) **2**. Apparatus for sublimation of anthracene, anthraquinone or other substances (U. S. pat. 1,644,518) **1**.

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Acetic acid. H. DREYFUS. *Brit.* **262,832**, June 13, 1925. Equimol. proportions of CO and H are passed under pressures of 50-200 atm. and at temps. of $200-300^\circ$ or somewhat higher (but under 450°) over substances such as Cu oxide, Sn oxide, Pb oxide, Cu acetate, Al methylate, Sn methylate or their mixts. Cf. *C. A.* **21**, 3368.

Acetic acid. P. A. SMITH and H. G. SMITH. *Can.* **273,715**, Sept. 6, 1927. Alkali acetate is produced by leading methanol vapor under pressure in presence of H_2 under pressure over a molten alkali formate at $200-300^\circ$.

Acetic acid. STOCKHOLMS SUPERFOSFAT FABRIKS A.-B. *Swed.* **62,474**, March 1, 1927. AcH is oxidized with O_2 or air with or without the aid of a catalyzer. The reaction components are brought together in stills filled with solid diluents in order to avoid explosions.

Anhydrous salts of lower fatty acids. H. VON HOCHSTETTER. U. S. **1,645,265**, Oct. 11. Anhyd. esters such as EtOAc are caused to react with NaOH or other anhyd. hydroxides in the presence of org. solvents such as anhyd. EtOH .

Benzoic acid from phthalic anhydride. COURTNEY CONOVER. U. S. **1,645,180**, Oct. 11. A mixt. of H_2O vapor and phthalic anhydride vapor is subjected to the action of a catalyst such as ZnO .

Lead compound of thioglycolic acid. E. LYONS. U. S. **1,644,258**, Oct. 4. A compd. of the formula $\text{Pb}(\text{SCH}_2\text{COONa})_2$ is obtained by treating thioglycolic acid with $\text{Pb}(\text{OH})_2$ in the presence of Na_2CO_3 and pptg. with MeOH and ether. It is of golden yellow color, sol. in H_2O and alk. to phenolphthalein and is of low toxicity.

Arylamides of 2,3-hydroxynaphthoic acid. BRITISH SYNTHETICS, LTD. AND E. B. HIGGINS. *Brit.* **262,958**, Dec. 28, 1925. Arylamides of 2,3-hydroxynaphthoic acid are

made by interaction of 2,3-hydroxynaphthoyl chloride and aromatic amines not contg. electronegative substituents in the presence of a weak alkali by mixing the reacting materials in various specified methods and orders. The reaction temp. should not exceed about 60°.

Calcium salts of inositol-phosphoric acid. A. GAMS and M. GIRARD. U. S. 1,645,233, Oct. 11. Compds. of inositol-phosphoric acid of the formula $C_6H_{12}O_{27}P_6X$ (in which the 12 H atoms represented by X are substituted wholly or in part by Mg) are caused to react, under acid conditions, with Ca compds. such as $CaCl_2$ which are sol. in the reaction medium and whose anion yields with Mg a salt sol. in dil. alc.

Calcium salts of inositol-phosphoric acid. A. GAMS and M. GIRARD. U. S. 1,644,246, Oct. 4. Compds. of inositol-phosphoric acid of the formula $C_6H_{12}O_{27}P_6X$ (in which the 12 H atoms represented by X are substituted wholly or in part by Mg) are treated with alkali metal hydroxide and the alkali compds. thus formed are treated with $CaCl_2$ or other Ca compds. of sufficient soly. to effect reaction. The Ca salts thus formed are pptd. by alc.

Cyclohexyl ester of phthalic acid. F. F. REID AND G. L. SCHWARTZ. U. S. 1,543,393, Sept. 27. Esters of phthalic acid in which the H of one COOH group is substituted by the cyclohexyl group and the H of the other COOH group by an open-chain alkyl or an aryl radical such as cyclohexyl *n*-butyl phthalate, are formed by heating phthalic anhydride with cyclohexanol and then with *n*-BuOH or other component.

Esters of mixtures of adipic acids. W. CLAASEN. U. S. 1,643,619, Sept. 27. Hydrogenated crude cresols are oxidized, *e. g.*, by boiling HNO_3 of 1.2 sp. gr., to form mixts. of adipic acids and the acid mixt. is esterified *e. g.*, by treatment with EtOH and gaseous HCl, without preliminary sepn. of the mixt. into its components. The products are colorless and sweet smelling.

Acid amides. P. A. SMITH and H. G. SMITH. Can. 274,065, Sept. 20, 1927. $AcNH_2$ is produced by passing a mixt. of MeOH vapor and HCN over a catalyst at a high temp.

Ethyl ether. K. E. SKARBLUM. Swed. 61,991, Nov. 23, 1926. EtOH vapor is passed over hydrated Al_2O_3 at a temp. below that necessary for the production of C_2H_4 alone. Cf. C. A. 21, 917.

Methane. F. KLATTE and J. SÖLL. U. S. 1,643,663, Sept. 27. A current of gases contg. CO and H is treated with a Ni catalyst at a temp. above 500° and the velocity of flow of the gases is regulated to avoid sepn. of C and quickly to remove the gases from the hot reaction zone.

Conversion of methane into hydrocarbons. G. OLIVIER. Can. 274,783, Oct. 18, 1927. CH_4 is converted into hydrocarbons of higher C content by leading an annular stream of CH_4 of very small thickness through zones of gradually increasing temps., the products formed being subjected to a vacuum and suddenly cooled as they come out of the hottest zone.

Acetaldehyde. W. O. HERRMANN and H. DEUTSCH. Can. 274,219, Sept. 27, 1927. AcH is produced by causing C_2H_2 to react upon H_2O in the presence of Hg compds and acid, adding solvents for the C_2H_2 , and working under an excess pressure up to 3 atms.

Solid formaldehyde-containing composition. SKÅNSKA ÄTTIKFÄBRIKEN. Swed. 62,763, April 13, 1927. CH_2O is mixed with one or more bivalent water-sol. alcs. or corresponding aldehydes, ketones, hydroxy aldehydes or hydroxy ketones.

Urea and formaldehyde product. A. GAMS and G. WIDMER. Can. 274,266, Sept. 27, 1927. Condensation products are obtained from urea or urea derivs. and CH_2O , the condensation being conducted in presence of active C and at ordinary temp. in order to obtain dimethylolurea. The active C is eliminated by filtration and the filtrate evapd. at low temp.

Aldehyde resins. W. O. HERRMANN, H. DEUTSCH and W. HAEHNEL. U. S. 1,643,496, Sept. 27. Non-phenolic aldehyde resins such as those prepd. from AcH or crotonaldehyde are treated with org. hydroxy-carboxylic acid compds. such as ricinoleic or dihydroxystearic acid, or castor oil, to improve the color, elasticity, soly. and fusibility.

Tetra-ethyl lead. H. W. DAUDT, A. E. PARMELEE and WM. S. CALCOTT. U. S. 1,645,375, Oct. 11. In effecting reaction between $EtCl$ and mono-sodium-lead, there is added to the reaction mass, subsequent to the completion of the reaction, a dispersing substance such as Turkey red oil, C_6H_6 glue, agar-agar or lard oil which is adapted to form a H_2O -insol. film on the surface of the particles of the mass, which serves to facilitate handling and sepn. of Et_4Pb by distn.

Tetra-alkyl lead compounds. K. P. MONROE. U. S. 1,645,389, Oct. 11. Pb ,

associated with an element such as Na capable of liberating H from H_2O , is treated with EtBr or other alkyl halide in the presence of a catalyst of the type used for the Grignard synthesis, and H_2O is added to the reaction mass to cause reduction of the complex first formed to dialkyl Pb; the latter is thermally decomposed into tetra-alkyl Pb. U. S. 1,645,390 specifies treating 1 atomic proportion of Pb, alloyed with not more than 2 atomic proportions of an element such as Na capable of liberating H from H_2O , with an alkyl halide and H_2O together with another substance such as EtOH capable of increasing the miscibility of the H_2O in the liquid phase of the reaction mixt.

Alcohols. G. PATART. Can. 273,983, Sept. 20, 1927. A method for the synthetic production of higher-mol. org. compds. contg. O consists in reducing CO by H_2 in the presence of a catalyzer and under high pressure. The products thus obtained are condensed and the methanol and other compds. having a lighter mol. wt. than the higher compds. to be produced are sep'd. from the condensates. The methanol and other compds. are again subjected to a catalytic reduction under high pressure. Cf. C. A. 21, 1128.

Alcohols. G. PATART. Can. 273,984, Sept. 20, 1927. A method of synthesizing higher alcs. consists in subjecting a mixt. of C oxides and H_2 at a high pressure and temp. to the action of a catalyzer formed of a very intimate mixt. of 30% ZnO and 70% neutral K_2CrO_4 by wt. Cf. C. A. 21, 1128.

Hydrocarbon. A. MITTASCH, M. PIER, R. WIETZEL and H. LANGHEINRICH. Can. 273,685, Sept. 6, 1927. Aromatic hydrocarbons are produced by heating cycloparaffins and naphthenes with a catalyst comprising active charcoal and a compd. of a metal of the 6th group of the periodic system.

Light hydrocarbons by catalytic hydrogenation of oxygen-containing compounds. D. FLORENTIN, A. KLING and C. MATIGNON. Brit. 263,082, Dec. 17, 1925. Compds. such as phenol, cresols, phenolic oils, derivs. of cyclohexanol, shale oils and vegetable and animal oils are treated with H (with or without the presence of CO or hydrocarbon gas) at 350–480° in the presence of dehydrating catalysts such as thoria, Al_2O_3 and SiO_2 . $AlCl_3$ also may be used in some instances.

Hydrazo compounds. R. A. NELSON and A. PRASIL. U. S. 1,644,483, Oct. 4. In order to sep. hydrazanisole or other hydrazo compds. from admixt. with ZnO residues and alc., the alc. is directly distd. off and the hydrazo compd. is extd. from the residue by use of C_6H_6 or other solvent immiscible with H_2O .

Reducing nitro compounds. R. A. NELSON and A. PRASIL. U. S. 1,644,484, Oct. 4. In the formation of hydrazobenzene from $PhNO_2$ or in other similar reductions of nitro compds., the latter, in soln. in C_6H_6 or other org. solvent immiscible with H_2O , are reduced with Zn and caustic alkali (an excess of Zn is employed over that required to form zincate with the caustic alkali).

Production of acids, oils, alcohols, etc., from organic materials. J. H. WALLIN. Swed. 63,605, Aug. 30, 1927. The org. materials are heated under pressure with a soln. of caustic alkali, with or without the addn. of alkali carbonate. A sufficient excess of alkali is used to neutralize all the acid formed. The temp. should be not less than 250° with an at least corresponding pressure.

Iodination process. C. RATH. Can. 274,178, Sept. 27, 1927. Pyridine derivs. are treated with I or substances furnishing I in the presence or absence of solvents and in faintly alk. or neutral medium with the coöperation of substances, such as the alkali salts of weak acids like CO_2 or H_3BO_3 , capable of combining the HI liberated.

Vanillin. R. H. BORS. U. S. 1,643,804, Sept. 27. $PhNO_2$ is used for the oxidation of isoeugenol or other compds. having a C_6H_5 nucleus and a lateral chain $CH:CH-CH_3$ to produce corresponding aldehydes. U. S. 1,643,805 specifies a similar process, in which a K compd. of isoeugenol may be used with $PhNO_2$ and aniline and an excess of NaOH.

Dinitrotoluene. BRITISH DYESTUFFS CORPORATION, E. H. RODD and R. W. EVERATT. Brit. 263,018, May 12, 1926. Dinitrotoluene setting at temps. below 20° is obtained by nitrating a mixt. of mononitrotoluenes contg. less than 45% *m*-nitrotoluene, crystg. the product, and sepg. the liquid fraction from the solid. The temp. for the crystn. varies with the proportion of *m*-nitrotoluene in the starting material and may be about 18–25° with a mixt. of mononitrotoluenes contg. 33% *m*-nitrotoluene.

Aminoanthraquinone. D. G. ROGERS. U. S. 1,644,494, Oct. 4. An anthraquinonesulfonic acid is heated with aq. NH_3 in the presence of an org. nitro compd. such as $PhNO_2$ and of an NH_4 salt, e. g., NH_4Cl .

***dl*-Nerolidol.** L. RUZICKA. U. S. 1,644,546, Oct. 4. *dl*-Nerolidol, a colorless liquid, b_p 145°, having a faint "odor of flowers" and convertible by chromic acid into farnesal, whose semicarbazone m. 133°, is obtained by treating the Na compd. of the

α,β -dihydropseudoionone with C_6H_5 and reducing the methylethynylhomogeranyl-carbinol so formed.

Anthraquinone-nitrosamine compound. H. TESCHÉ and A. JOB. U. S. 1,643,428, Sept. 27. Anthraquinonenitrosamine compds. of the general formula, $C_{14}H_7O_2-N.NO.R$, in which R is an alkyl, aralkyl or aryl radical, e. g., *N*-nitroso-2-methylaminoanthraquinone, are made by reacting with a HNO_2 compd., e. g., with $NaNO_2$ in the presence of glacial HOAc at a temp. of about 40° or lower, on 2-methylaminoanthraquinone or other compds. of the general formula $C_{14}H_7O_2-N-H.R$.

2-Hydrazino-5-nitropyridine. C. RATH. Can. 274,179, Sept. 27, 1927. 2-Hydrazino-5-nitropyridine is produced by reaction of 2-halo-5-nitropyridine with $N_2H_4.H_2O$.

11—BIOLOGICAL CHEMISTRY

PAUL E. HOWE

A—GENERAL

FRANK P. UNDERHILL

The influence of temperature on the optimal hydrogen-ion concentration for amylolytic action. H. LUEKS and S. NISHIMURA. *Wochschr. Brau.* 43, 415-6(1926).—The work of Olsen and Fine could not be confirmed. A soln. of sol. starch buffered with acetate-acetic acid mixt., which had a p_H range of 3.5 to 6, was converted by an amylase prepd. according to Sherman and Schlesinger. Within a temp. range of $15-70^\circ$ the optimum p_H was found to vary from 4.4 to 4.6. B. C. A.

The crystallization of starch. H. L. VAN DE SANDE-BAKHUYZEN. *Proc. Soc. Exptl. Biol. Med.* 23, 506-7(1926).—Alc. was added to amylose soln. and let stand at 100m temp. for 3 weeks; spherocrystals, built up of radial needles, were in the ppt. C. V. B.

The problem of the decomposition of grape sugar in the animal organism. A. ALEKSEEV. *Bull. Univ. Aise centrale* (Taschkent) 10, 39-49; *Chem. Zentr.* 1926, II, 256.—To prove the existence of *reductase* and *carboxylase* in animal tissues, the evolution of CO_2 from lactic acid solns. treated and neutralized with tissue ext. was studied: $MeCH(OH)CO_2H \rightarrow MeCOCO_2H + AcH + CO_2$. The evolution of CO_2 was very small when the ext. had previously been boiled. By addn. of methylene blue to the unboiled ext. it was considerably increased. The aq. ext. from beef liver and muscle was most active at p_H 7.0. Aq. exts. of ox lung and brain, sheep liver, muscle and lung and fresh human liver were tested. Since lactic acid plays an important part in the decompn. of glucose, the expts. show unmistakably the importance of *reductase* and *carboxylase* in internal respiration processes. C. C. D.

Expressed juices of organs. I. The nucleoprotein content of expressed juices. II. Investigations of the formation of expressed juices, with special reference to the influence of the pressure used for expressing the juice on the composition of the latter. G. GRUND and H. JASTROWITZ. *Z. exptl. Med.* 48, 365-80, 381-91; *Chem. Zentr.* 1926, II, 1964.—An investigation of the phys.-chem. condition of the cell substances was made with the special object of detg. whether finely dispersed and coarsely dispersed components are distinguishable and can be sepd. To this end organs were ground fine with diatomaceous earth and forced through linen cloth under high pressure. In the expressed juice and in the organ pulp, albumin, globulin, neutral fat, cholesterol, phosphatides, cholesterol esters and nucleoprotein P were detd. by known methods. There were significant differences between the analyses of the organs and the expressed juice (calcd. on a basis of wet substance) which allowed certain definite conclusions. The substances which are present in the highest proportions in the expressed juice must be in colloidal soln., and substances which are not present in the juice but which are present in high proportion in the organs must be in coarse suspension or in the gel form. The latter is true of the nucleoproteins. To det. the influence of the pressure on the compn. of the expressed juices, juices from the same source but prepd. under different pressures were analyzed. The results show that with increasing pressure (from 75 to 300 atm.) the concn. of dissolved protein in the juices decreased as soon as a gel was present in the pressed pulp. This was confirmed by sep. expts. with grape sugar solns., gelatin, etc., and is attributed to changes in the size of the pores of the diatomaceous earth under pressure. The phenomena are simpler with crystalloids, for the analyses of the juice give a fairly accurate representation of

the conditions existing in the organs. A distinct increase of NaCl in the juice with increasing pressure was, however, noted. C. C. DAVIS

The reversibility of enzyme reactions. I. The breakdown and synthesis of uric acid. ST. J. PRZYŁECKI. *Ann. physiol. physicochim. biol.* 3, 381-421(1927); cf. C. A. 21, 2508.—From *in vitro* expts. with hashed mammalian liver, P. concludes that the breakdown of uric acid in the living organism is irreversible. The action continues until all of the uric acid disappears. The presence of allantoin in excess does not retard the rate of destruction of the uric acid, and no synthesis occurs when one uses uricase with allantoin. The synthesis of uric acid by uricoligase (an enzyme in the hashed liver of birds) was also found to be irreversible. The synthesis does not depend on the liver itself as it occurs with the ground tissue to which CHCl_3 or toluene has been added. The latter enzyme is also present in the juice expressed from the liver of birds and some invertebrates. The synthesis is brought about by an enzyme since the potency of the liver prepn. is destroyed by boiling. When uricase is added to the tissues which are synthesizing uric acid, there is a decrease in the rate of formation or a breakdown of the existing uric acid. H. J. DEUEL, JR.

The physiological importance of inositol. JOSEPH NEEDHAM. *Ergebnisse physiol.* 25, 1-45(1926).—A review contg. an historical outline, and covering the distribution, chemistry, methods of detn., bacteriology, and relation to enzymes of *i*-inositol. Its relation to phytin and phytase is discussed as well as the metabolism of inositol in plants and animals, the latter both under physiol. and pathol. conditions. A crit. analysis of the 4 theories of its physiol. significance is given. N. believes in common with Starkenstein that inositol exists in the animal body as phytin but disagrees with S. by insisting that it must have a very important function. Its appearance in urine in various polyurias cannot be explained by a simple washing out of the tissues. When it is synthesized it must originate from glucose. Synthesis must be possible in the human to explain the continued excretion of as much as 20 g. daily over long periods of time. H. J. DEUEL, JR.

The occurrence, the cycle and the metabolism of iodine. TH. VON FELLEBERG. *Ergebnisse physiol.* 25, 176-353(1926).—A comprehensive review. H. J. D., JR.

The importance of radioactivity for the animal life. H. ZWAARDEMAKER. *Ergebnisse physiol.* 25, 535-73(1926).—A review. H. J. DEUEL, JR.

John Newport Langley. RENÉ DU BOIS-REYMOND. *Ergebnisse physiol.* 25, xv-xix(1926).—An obituary containing a splendid portrait of Langley. H. J. D., JR.

William Maddock Bayliss. F. H. STARLING. *Ergebnisse physiol.* 25, xx-xxiv(1926).—An obituary contg. a complete list of his published articles. H. J. D., JR.

Cozymase. XIV. Purification experiments. HANS V. FÜLER AND KARL MYRBÄCK. *Z. physiol. Chem.* 169, 102-22(1927); cf. C. A. 21, 3205.—The cozymase contained in the filtrate from boiled yeast was subjected to pptn. by various reagents for the purpose of purification. Increase in purity was ascertained by detg. the no. of cozymase units in each prepn., the unit being the amt. required to give a fermentation velocity of 1 cc. CO_2 per hr. when added to a specified mixt. of cozymase-free yeast, glucose and phosphate buffer. Starting with dried yeast H, which had a cozymase value of 300 units per g., the first operation was dialysis through collodion whereby proteins, glyco-gen and yeast gum were removed. The dialyzate was treated with neutral $\text{Pb}(\text{OAc})_2$ and the ppt. discarded. The filtrate was then made alk. after addn. of more $\text{Pb}(\text{OAc})_2$, the ppt. contg. cozymase was washed and the Pb removed by H_2SO_4 . The activity had now been increased to 2000-6000 units. Removal of phosphates and certain other impurities can also be effected by $\text{Ba}(\text{OH})_2$ or Mg mixt., but these reagents have no advantage over the $\text{Pb}(\text{OAc})_2$. Losses sustained in the purification treatment cannot be accounted for by a possible sepn. of cozymase into sep. components, since the sum of the activities of the fractions is always equal to the activity of the mixt. Fifty % EtOH removes certain impurities from the crude prepn., after which further addn. of EtOH to 70% ppts. cozymase with a purity of 3500. HgCl_2 does not ppt. cozymase, but $\text{Hg}(\text{NO}_3)_2$ gives a ppt. from which the cozymase may be recovered by removing the Hg by H_2S . In this way the $\text{Pb}(\text{OAc})_2$ prepn. with purity of 3000 was increased to 10,000. Further purification to 15,000 was accomplished by pptn. with HgSO_4 in neutral soln., whereas AgNO_3 and $\text{Ba}(\text{OH})_2$ treatment of the same prepn. gave a purity value as high as 20,000. Ammoniacal AgNO_3 gave in one instance a prepn. with purity of 55,000. The highest purity of all was attained by the use of silicotungstic acid in the presence of H_2SO_4 , which increased the value to 77,000 units per g. Other reagents which either failed to ppt. cozymase or gave only an insignificant increase in purity with considerable loss of material in the filtrate were PtCl_4 , AuCl_3 , Cu salts and picric acid. The Krüger method for pptg.

purines probably ppts. cozymase but the expts. were not conclusive. A prepn. with purity of 30,000 gave the following analysis: C 40.05, H 4.86, N 24.39, S 1.54, ash 9.46. P and amino N were absent. A 2% soln. showed no optical activity, and no biuret, Millon or ninhydrin reaction. The Molisch reaction for carbohydrate was intense, as also the phloroglucinol reaction for pentose, and the nitroprusside reaction. The murexide reaction was doubtful, and the Kossel reaction for purines, the pyrrole reaction and the diazo reaction were negative.

A. W. Dox

Biological disintegration and respiration processes with various groups of substances. HANS V. EULER, RAGNAR NILSSON AND DAGMAR RUNEIJELM. *Z. physiol. Chem.* 169, 123-63(1927).—The methylene blue reduction, so useful in many oxido-reduction studies, and the taking up of mol. O by enzymic material are not parallel processes. The velocity of methylene blue reduction should not be regarded as a measure of total respiratory power. It is especially adapted for the measurement of the anaerobic phase of carbohydrate break-down and of many other important processes. According to the authors' working hypothesis an enzymic degradation is effected by the so-called reductases, the process leading to more easily oxidizable substances. The mol. O respiration of these substances proceeds through the agency of oxidation catalysts which act to some extent like peroxidase. Concerning the activity of cozymase as a "respiratory body" the view is expressed and supported by expts. that the respiration of cozymase is not directly activated but the activation of respiration is brought about by the participation of cozymase in the dismutation-like transformation of glucose. Measurements of the O consumption of succinic acid showed that a succinodehydrogenase soln. can lose its respiratory power while its reducing action on methylene blue remains unimpaired and can be activated by addn. of succinate. A far-reaching parallelism was found between the cytochrome content of yeast and the respiratory power. When the cytochrome was in any way inactivated, whether by drying of the yeast or by poisoning with HCN, the respiration was inhibited no matter if the reductase remained entirely intact as shown by methylene blue expts. Of course, oxidation catalysts other than cytochrome might have participated, which on drying of the enzyme material or on addn. of HCN, are destroyed in the same manner as cytochrome. In attempts to use methylene blue as an artificial oxidation catalyst, respiratory activation was attained in the absence of natural oxidation catalysts by addn. of methylene blue. No conclusions can be drawn regarding oxidation velocity from oxidation potential alone. Lactic acid is attacked by yeast reductase without cozymase.

A. W. Dox

Peroxidase. V. **Mathematical consideration of the enzyme action.** H. W. BANSI AND H. UCKO. *Z. physiol. Chem.* 169, 178-95(1927); cf. *C. A.* 21, 1465.—The oxidation of pyrogallol by peroxidase proceeds according to the exponential equation, $u = k \cdot t^{1/a}$, where u = conversion, t = time, k = const., and the exponent represents the tangent of the angle of inclination of a bilogarithmic line. $1/a$ varies with the magnitude of the Freundlich adsorption isotherm between 0.3 and 1.0. $1/a = 1$, as an ideal limit, represents the linear course of the time-conversion equation; $1/a = 0.5$ represents the case of the Schütz rule for pepsin digestion. The exponential factor is dependent on the reaction of the medium and on the H_2O_2 concn. It expresses the retardation of the reaction. The decrease in reaction velocity is caused by adsorption of the enzyme on the purpurogallin formed.

A. W. Dox

Comparative investigations on the action of alkali, acids and enzymes on proteins, peptones, polypeptides, 2,5-diketopiperazines and substances of related structures. EMIL ABDERHALDEN AND HERBERT MAHN. *Z. physiol. Chem.* 169, 196-222 (1927).—The work described is part of an extensive investigation in which it is planned to study the effect of acid and alkali at various concns. and temps. on polypeptides contg. different combinations of amino acids and with different lengths of the chain, and on amino acid anhydrides and proteins. It has previously been shown that 2,5-diketopiperazines are hydrolyzed more easily by alkali than by acid. Expts. with *dl*-leucylglycine now show that this dipeptide is unaltered by *N* HCl at room temp. and slowly hydrolyzed at 70-5° and at 100°. *N* NaOH has no effect at room temp., but at 50-5° a slow hydrolysis and at 100° a rapid hydrolysis occurs. 2 *N* and 4 *N* NaOH act slowly at room temp. The corresponding anhydride is slowly hydrolyzed by 0.1 *N* NaOH at room temp. and rapidly by *N* alkali. *N* HCl at room temp. gives practically no hydrolysis, but hydrolysis occurs at 50-5° and more rapidly at 70-5°. The effect of *N* alkali and acid on a 10% soln. of elastin in *N* HCl was followed by means of detns., at stated intervals, of amino N, optical rotation and rotation of the Cu salts. The acid treatment resulted in a fairly uniform decrease in rotation, a change in rotation of the Cu salts from *d* to *l*, and a steady increase in amino N. The alkali

treatment had much the same effect except that the rotation of the Cu salts diminished without changing direction. After prolonged digestion of elastin with pepsin and 0.1 N HCl the effect of N NaOH was practically the same. A. W. DOX

Spectrophotometric comparison of natural with synthetic thyroxine. EMIL ABDEH-HALDEN and ERNST ROSSNER. *Z. physiol. Chem.* 169, 223-5(1927).—The spectrophotometric curves of natural thyroxine and of thyroxine prepd. by Hoffmann-La Roche by the Harrington and Barger synthesis coincide in all respects, indicating the identity of the 2 products. A. W. DOX

The adaptation of fresh culture yeasts to galactose. H. v. EULER and BRITA JANSSON. *Z. physiol. Chem.* 169, 226-34(1927).—Yeast does not acquire the property of fermenting galactose when the preliminary treatment with galactose is given in the presence of just sufficient PhOH to inhibit cell growth. Likewise an adaptation does not occur when cell growth is inhibited by a temp. of 38°. Adaptation to galactose is apparently a function of cell growth. When once acquired the adaptation is retained by the yeast even after drying. The change is in the zymase complex and not in the cozymase, since cozymase obtained from yeast either before or after adaptation is equally effective in activating the fermentation of galactose by adapted yeast from which the cozymase has been removed. A. W. DOX

The chemistry of the blood pigment. VII. Behavior of the prosthetic group in various solvents. FELIX HAUROWITZ. *Z. physiol. Chem.* 169, 235-62(1927); cf. C. A. 21, 3628.—The spectra of hemin, mesohemin, dimethylmesohemin and etiohemin and the corresponding hemochromogens were detd. in the presence and absence of cyanides and pyridine. In pyridine soln. the spectrum of the hemin is clearly distinguishable from that of the hemochromogen. The trimethylated product obtained by methylation of monomethylhematin with Me₂SO₄ contains additive MeOH in the unsatd. side chains; the FeOH group could not be methylated. The Cl atom of hemin is present as anion in all of the solvents investigated. In acid soln. the pigment residue migrates as a cation, and hemin is thus [RH]⁺Cl⁻. In alk. soln. both Cl and H are released by disocn., thus H⁺-[R]⁺Cl⁻. This occurs also when both CO₂H groups are esterified, so that a 3rd CO₂H must also be present in hemin. The action of HCN on Cl-hemin is similar to that of pyridine and PhNH₂. A compd. is formed which splits off HCl when poured into aq. AcOH, giving rise to de(HCl)hemin or hydroxyhemin. By the action of the bases pyridine and PhNH₂ the pigment residue becomes a cation, by the action of HCN an anion, and a complex linkage of the residues is probable. Pyridine acts on oxyhemoglobin with cleavage to globin, O₂ and pyridine-hemochromogen; on methemoglobin with cleavage to globin and pyridine-hydroxyhemin. A. W. DOX

Furan compounds derived from sugars. JUNJI KARASHIMA. *Z. physiol. Chem.* 169, 278-96(1927).—Hydroxymethylfuroyl chloride, b_p 120°, was prepd. in 88.9% yield by refluxing hydroxymethylpyromucic acid with SOCl₂. Condensation of this with glycine by shaking in the presence of N NaOH at a low temp. gave 40.2% of hydroxymethylpyromucuric acid m. 182°. Feeding expts. were made with several furan derivs. to det. the form in which the substances are eliminated. Chitose was excreted in the form of hydroxymethylpyromucic acid by rabbits, dogs, chickens and frogs, but only in small quantity, the max. recovery being 6.3%. Hydroxymethylfurfural gave the same product in 43.7-66.7% yield. Chitonic acid was administered subcutaneously as the Na and Ca salts and the original substance recovered to the extent of 8%, but no hydroxymethylpyromucic acid was found. Chitonic acid was recovered in only one case and then only 1%, and no hydroxymethylpyromucic acid found. A. W. D.

Amygdalase, gentiobiase, gentianase. KARL JOSEPHSON. *Z. physiol. Chem.* 169, 301-4(1927).—Discussion of a theoretically possible mode of detg. whether gentianase is identical with amygdalase or with gentiobiase. A. W. DOX

The action of suprarenal tissue upon lecithin. H. C. W. VINES. *Endocrinology* 11, 224-8(1927).—The incubation of dried suprarenal tissue in a saline medium (0.6% NaCl, 0.2% NaHCO₃, and 0.1% glucose) at p_H 7.4 and 37° with lecithin (0.5 g. per 100 cc. solvent) caused a lipolysis of lecithin. This effect was increased in the presence of cholesterol and cholesterol esters were formed. Choline is probably attacked since HCOOH was found in the distillate. It is suggested that the side chain of the adrenaline mol. may be derived from choline. H. J. DEVEL, JR.

The influence of certain colloids upon fermentation. R. GRIEG-SMITH. *Proc. Linnean Soc. N. S. Wales* 52, Pt. 2, 17-24(1927); cf. C. A. 20, 3207.—Heating yeast to nearly the lethal temp. caused inversion of sucrose to take place, but the mineral colloid did not affect the invertase which is assumed to be responsible for the action. The invertase of normal yeast is adsorbed by the colloid. Alcoholic fermentation of

sucrose by heated yeast is accelerated by mineral colloids, and the rate of fermentation of dextrose by normal yeast is increased by fuller's earth. Small quantities of agar depress while large quantities accelerate the fermentation of invert sugar.

C. N. FREY

Investigation of hydrogenase. J. GRÜSS. *Wochschr. Brau.* 43, 265-8(1926).—The following butyric acid organisms were used in this investigation: *B. butyricus*, *E. amylocymicus*, *B. levans* and *B. corticalis*. These organisms produce H during fermentation. (1) glucose \rightarrow $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH} + 2\text{CO}_2 + 2\text{H}_2$; (2) glucose \rightarrow $\text{CH}_3\text{CHOHCOOH}$; (3) glucose \rightarrow $\text{HCOOH} + \text{CH}_3\text{COOH} + \text{CH}_3\text{CH}_2\text{COOH}$; (4) glucose \rightarrow $\text{CH}_3\text{COOH} + (\text{CH}_3\text{COOH})_2 + \text{C}_2\text{H}_5\text{OH} + \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH} + \text{HCOOH} + \text{CO}_2 + 2\text{H}_2\text{O}$; (5) glucose \rightarrow $2\text{CH}_3(\text{CH}_2)_4\text{COOH} + \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{COOH} + 4\text{CO}_2 + 4\text{H}_2\text{O}$. H was absorbed by Pd foil either by placing it in the soln. or outside of the fermenting soln. The Pd foil is then placed in a measured violamine soln. (tetramethyl-*p*-phenyldiamine-HCl) which has been oxidized. If H is present the violamine soln. is decolorized. Free mol. H does not act on violamine. Therefore Pd acts as a catalyst: $\text{Pd} + (\text{H}_2)_2 = \text{Pd} + n\text{H}_2 = \text{PdH}_{2n}$, $\text{PdH}_{2n-2} + \text{VO} = \text{H} + \text{II} + \text{VO}$, $2\text{H} + \text{VO} = \text{H}_2\text{O} + \text{V}$. (V = violamine.)

C. N. FREY

The diastase content of grains. STAIGER. *Z. Spiritusind.* 50, 173(1927).—Diastase content in terms of Lintner for various samples of rye, barley and wheat is given. One sample of barley had a Lintner of only 17 and a sample of rye had 106°, the highest in the group.

C. N. FREY

Placental hormone (feminin). E. GLIMM AND F. WADEHN. *Klin. Wochschr.* 6, 999-1000(1927); cf. *C. A.* 21, 1280.—A placental hormone has been prepd. which contains 1 mouse unit of activity in 0.006 mg. of material. The substance is a pale-colored oil, sol. in ether and in dil. alkalies. The method of prepn. is described in detail.

MILTON HANKE

Reversal of the anion permeability of erythrocytes to one of an elective permeability for cations, by alkalization. RUDOLF MOUND. *Klin. Wochschr.* 6, 1432(1927).—Blood cells are known to be electively permeable to anions. This can be changed so that the cells become electively permeable to cations by alkalization of the suspension medium to p_{H} 8.0 to 8.3.

MILTON HANKE

The behavior of adrenal lipase toward poisons and the clinical importance of this behavior. M. N. CHEBOKSAROV AND Z. J. MALKIN. *Klin. Wochschr.* 6, 1472-4(1927).—Adrenal lipase is resistant toward quinine, strychnine, cocaine, tartar emetic, Na salicylate, ext. of belladonna and diphtheria toxin. It is inactivated by atoxyl and chloral hydrate.

MILTON HANKE

Physicochemical explanation of the normal bone-formation, formation of crystalline deposits in disease and the influence of alkalies on the metabolism. N. R. DHAR. *Z. anorg. allgem. Chem.* 162, 243-50(1927).—The mechanism of the normal bone-formation is plausibly explained as follows: $\text{Ca}_3(\text{PO}_4)_2$ and CaCO_3 in the body are chiefly present as colloids. These colloids are adsorbed by the solid $\text{Ca}_3(\text{PO}_4)_2$ and CaCO_3 of the bones, and coagulated. The ppt. thus obtained acts as a coagulation agent toward the sols of Ca salts, and consequently the ppt. increases gradually. The decrease of the bone-formation in old age can be explained by assuming that the colloids of the body acquire a high peptization power; this would be connected with the loss of water occurring in old age. Dead tissues and foreign substances act as a nucleus in the adsorption and coagulation of little sol. sols like CaCO_3 , $\text{Ca}_3(\text{PO}_4)_2$, urea, CaC_2O_4 , etc.; the formation of ppts. depends on the concn. of the body colloids, which act as peptization agents. The OH ions accelerate the metabolism and are of high importance in the treatment of many diseases. The citrate ions stabilize milk and blood; they do so by increasing their elec. charges.

A. L. HENNE

The iodine content of the thyroid in the Japanese fetus, newborn child and at the age of puberty. T. NOSAKA. *Folia endocrinol. japon.* 2, 1-17(1926); *Ber. ges. Physiol. expil. Pharmacol.* 41, 99.—I is detectable in the fetal thyroid from the 6th month on and increases with progressing age first gradually, then at puberty rapidly. The wt. of the thyroid is lower, the I percentage higher than in the European. The water content is lower in the adult gland.

MARY JACOBSEN

The formation of fats by microorganisms. G. SELIBER. *Monographs Sci. Inst. in honor of P. E. Lesgaft, I Leningrad (Russia)* 1926, 1-110.—The monograph takes up the subject of fats in algae, bacteria and fungi; the methods of chem. analysis of fat, the cultivation of fat-decomposing organisms, microchem. reactions, extn. of fat, the constns. which characterize fats, reactions showing the decompn. of fat in microbial culture, fat-decomposing microorganisms and the nature of fat decompn. by micro-

organisms. It also deals with the decompn. of fats and the formation of carbohydrates and of adipocere in dead bodies.

J. S. JOFFE

The treatment of acid and alkali burns. E. C. DAVIDSON. *Ann. Surgery* **85**, 481-9(1927).—Concd. acids react with the skin promptly. With increased diln. there is a striking prolongation of the latent period. Concd. HCl is much less caustic than concd. HNO₃ or H₂SO₄. NaOH and KOH react only after prolonged latent periods. Treatment with water is better than through neutralization. The latter should be used only after most of the caustic has been removed by the water.

FRANCES KRASNOW

Behavior of pyrimidine derivatives in the organism. AMANDUS HAHN AND W. HAARMANN. *Z. Biol.* **85**, 275 9(1926).—Yeast ext transforms 5-methylcytosine to thymine as well as cytosine to uracil. Isocytosine and 4-methylisocytosine are not attacked by yeast.

FRANCES KRASNOW

The thermodynamics of temperature changes in collagen. EDGAR WOHLISCH AND RENÉ DU MÉSNIL DE ROCHEMONT. *Z. Biol.* **85**, 406-34(1927).—The changes are endothermic and are reversible.

FRANCES KRASNOW

The physiological chemistry of fibrinogen. II. Solubility and acid-combining properties in physiological salt solution. EDGAR WOHLISCH AND JACOB SCHLOSS. *Z. Biol.* **85**, 542-50(1927); cf. *C. A.* **18**, 3610.—Minimum soly. is obtained at p_H 4.46. On both sides of this fibrinogen can bind H ion.

FRANCES KRASNOW

The nature of the combination between certain acid dyes and proteins. R. A. GORTNER. *J. Biol. Chem.* **74**, 409-13(1927).—A recent paper by Chapman, Greenberg, and Schmidt (*C. A.* **21**, 1822) contains data which they interpret as indicating that certain conclusions reached by Hoffman and Gortner (*C. A.* **19**, 2961) are in valid but these data appear to be capable of an exactly diametrically opposite interpretation and as such offer striking substantiation of the conclusions of H. and G. The stoichiometrical reactions between the proteins and dyes used in their expts are not necessarily reactions between primary valences but may be regarded as entirely an electrokinetic phenomenon as claimed by H. and G. The originals should be consulted.

A. P. LOTHROP

The iron content of animal tissues. C. A. ELVEHJEM AND W. H. PETERSON. *J. Biol. Chem.* **74**, 433-41(1927).—The following percents of Fe were found in certain fresh beef tissues: bone marrow 0.0009, brain 0.0023, heart 0.0811, hide 0.0047, intestine 0.0034, kidney 0.0055, liver 0.0083, lung 0.0122, pancreas 0.0060, spleen 0.0089, muscle round steak 0.0041, muscle T-bone steak 0.0037. The % of Fe in rabbit tissues is of the same order of magnitude. A no. of analyses of spleen, liver and kidney taken from different animals are given and give valuable information regarding the relative value of these tissues in the cure and prevention of anemia. The % in beef, calf and hog liver, resp. is 0.0083, 0.0054 and 0.0250; in beef, calf and hog spleen 0.0091, 0.0255 and 0.0294. Beef juice prepd. in the same way as for infant feeding contains only 0.0029% of Fe.

A. P. LOTHROP

The nature of enzymes. K. G. FALK. *J. Am. Leather Chem. Assocn.* **22**, 508 21(1927).—An address.

H. B. MERRILL

Studies of proteins. X. The density and the optical rotatory power of albumin solutions. HANS JØRSEN-HANSEN. *Compt. rend. trav. lab. Carlsberg* **16**, No. 10, 20 pp.(1927).—The influence of the concn. and of the H-ion concn. on the densities and rotatory power of albumin solns. has been studied. The multiplicity of the data are not amenable to abstracting.

J. H. PERRY

Ultra-violet absorption spectra of certain physiological fluids. M. C. REINHARD. *J. Gen. Physiol.* **11**, 1-6(1927).—Ultra-violet absorption curves are given for human bile from post-mortem examn., human saliva, pericardial fluid, and urine, uric acid, albumin, pseudoglobulin, euglobulin, hemoglobin and blood serum. The app. and method are described in detail.

C. H. R.

Kinetics of the swelling of cells and tissues. J. H. NORTHROP. *J. Gen. Physiol.* **11**, 43-56(1927).—The rate of swelling of *Arbacia* eggs (Lillie, *C. A.* **10**, 1786; Lucke and McCutcheon, *C. A.* **20**, 2512), and of slices of potato or carrot (Stiles and Jørgensen, *C. A.* **12**, 1205) may be expressed, resp., by equations previously derived (cf. Northrop, *C. A.* **21**, 3295) for the rate of increase in vol. of a soln. enclosed in a collodion sac, and for the swelling of blocks of gelatin.

C. H. R.

Some aspects of bioelectrical phenomena. W. J. V. OSTERHOUT. *J. Gen. Physiol.* **11**, 83-99(1927).—Single cells have a no. of advantages over tissues for the study of bioelec. phenomena. The structure of protoplasm is discussed in relation to bioelec. phenomena and it is shown that measurements of p. d. can be used under certain circumstances to det. what ions enter protoplasm. The p. d. across the cell protoplasm

can be ascertained at single points instead of being measured only as the difference between 2 points. C. H. R.

Diastatic hydrolysis of melezitose and of turanose. M. BRIDEL AND TH. AAGAARD. *Bull. soc. chim. biol.* 9, 884-907(1927).—Turanose was not hydrolyzed by almond emulsin, rhamnodiastase or the sucrase of top yeast, but was readily hydrolyzed by a maceration of air-dried bottom yeast which contains α -glucosidase. Accordingly turanose is an α -glucoside of fructose formed by a union of 1 mol. of fructose and 1 mol. of glucose obtained by the dil. acid hydrolysis of melezitose. Melezitose is not hydrolyzed by the sucrase of yeast. Almond emulsin hydrolyzed melezitose very slowly in a manner undetd. In comparing the action of hydrolyzing powders obtained from *Aspergillus niger* on sucrose and melezitose it is seen that it is not the same enzyme which causes the hydrolysis of these sugars. The maceration of air-dried bottom yeast hydrolyzes melezitose to glucose and fructose and the hydrolysis is arrested on account of the rapid destruction of the α -glucosidase which acts on the turanose portion of the mol. The non-reduced hexobiose formed in the course of this hydrolysis is at once decompd. by another enzyme existing in the maceration. The exact nature of the non-reducing glucofructose existing in the melezitose mol. is not known. I. W. RIGGS

Protection of catalase against anticatalase by ethyl alcohol. S. R. ZUBKOWA AND E. M. RIAKHINA. *Compt. rend. soc. biol.* 97, 524-5(1927).—Alc. added to a mixt. of catalase and anticatalase and distd. gave no trace of aldehyde in the distillate. The mechanism of this action is not explained. L. W. RIGGS

Nature of albumins measurable by "error of proteins." R. GOFFON AND R. HAUDUQUET. *Compt. rend. soc. biol.* 97, 570-1(1927); cf. C. A. 21, 3642.—Only the complex albumins require an appreciable quantity of acid for the error of protein reaction. Com. peptones have only 0.1 the action of egg albumin. It is possible that the index given by peptones is due to other factors than the error of protein, and that they act as a salt of a weak acid. It is difficult to measure the HCl index of error of protein because of flocculation which interferes with a comparison of the tints. CO_2 -globulin gives a very slight index of error of protein. With colloidal pseudo-solns. such as starch paste or gum arabic the phenomenon of error of protein does not occur. L. W. RIGGS

The cytochrome, an intracellular respiratory pigment common to microorganisms, plants and animals. D. KEILIN. *Compt. rend. soc. biol.* 97, No. 24, Appendix 39-70 (1927).—A description of cytochrome and its relation to other org. pigments is followed by a discussion by several members of the Soc. Biol. The résumé and conclusions, in 22 paragraphs, fill 2 pages. L. W. RIGGS

Salts of α -linolic tetrabromide (Cd, Co, Cu, Mg, Mn) from Philippine lumbang oil. C. M. JOVELLANOS AND A. P. WEST. *Philippine J. Sci.* 33, 349-56(1927).—Lumbang oil is obtained from seeds of *Aleurites moluccana*. It is a drying oil suitable for paints, varnishes and similar products. Alpha-linolic tetrabromide was first prepd. by the method of Santiago and West. This after purification m. 112.3-114.3°. The K salt of this acid was prepd. and an alc. soln. of this salt was treated with an alc. soln. of a salt of a metal mentioned in the title, by boiling the mixt. under a reflux condenser. The pptd. salt thus obtained was purified and its m. p. and soly. were detd. $\text{C}_{18}\text{H}_{32}\text{Br}_4\text{O}_2\text{Cd}$ m. 135.7-137.8°, the Co salt m. 156.5°, the Cu salt m. 142.4-145.4°, the Mg salt m. 150.1-151.7°, and the Mn salt m. 144.9-147.5°. CHCl_3 is the best solvent for the Cd and Cu salts and Et benzoate for the Mn salt. The Co and Mg salts were only slightly sol. in a few solvents. L. W. RIGGS

Hexose-cleaving enzyme system in muscle. HANS V. EULER AND KARL MYRBACK. *Svensk Kem. Tids.* 39, 102-7(1927). (In German.)—Cozymase of yeast and a similarly acting material extd. from muscle are identical substances. A. R. ROSE

Influence of magnesium salts on the coagulation of blood rendered incoagulable by citrate or phosphate. (MLLÉ.) E. SLUITER. *Arch. néerland. physiol.* 10, 461-7 (1926).—Blood or plasma rendered incoagulable by Na citrate or phosphate could be coagulated by the addn. of a 10% soln. of commercial fructose; 1 cc. of the sugar soln. coagulated 9 cc. of citrated blood in 25 min. The phenomenon did not occur with glucose, lactose, maltose or sucrose and was not due to the Ca present. The theory was first advanced that a Ca fructose complex was formed due to the presence of the ketone grouping; this later ionized giving free Ca ions. Purified fructose was inactive and analyses of the commercial product showed the presence of MgCl_2 which liberated the Ca ions from the Ca citrate, but not from the oxalate. M. H. SOULÉ

Solubility of non-radiated cholesterol in liquid ammonia. R. G. GUSTAVSON AND J. B. GOODMAN. *J. Am. Chem. Soc.* 49, 2526-8(1927).—The soly. of non-radiated

cholesterol in liquid NH_3 (mg. per 100 cc.) is reported as follows: -38° , 0; 0° , 6.16; 7° , 20.2; 14° , 27.2; 21° , 72.6; 28° , 117.2; 35° , 232.2; 42° , 301.2; 49° , 545. The soly. at -38° is beyond the sensitiveness of the Liebermann-Burchardt test. Liquid NH_3 can be used to sep. certain prepn_s of cholesterol. C. J. WEST

Catalytic decomposition of hydrogen peroxide by hemin. HANS V. EULER AND KARL JOSEPHSON. *Ann.* 456, 11J-26(1927).—With pure catalase the catalytic ability is greater than 43,000; colloidal Pt, about 40; hemin, about 5. The effect of the concn. of H_2O_2 and of hemin is shown by tables and curves. C. J. WEST

Decomposition of free and combined cystine with special reference to certain effects produced by heating fish flesh. L. H. ALMY. *J. Am. Chem. Soc.* 49, 2540-5 (1927).—When fresh fish flesh is heated in a sealed tube at 120° for 45 min., either no H_2S or only a comparatively small quantity could be detected in the heated flesh. When the flesh had become somewhat stale, the same heat treatment yielded H_2S in relatively large amts. Added cystine increased the amt. of residual H_2S only with the stale flesh. The cause of this difference in results with fresh and stale flesh was traced to the ability of the fresh flesh, and conversely, the inability of stale flesh, to destroy H_2S formed by the heating. The H_2S is apparently destroyed by oxidation. Cystine added to fresh flesh, as well as that present in combined form in the flesh, is partially destroyed by this heating. The presence of considerable H_2S in a canned product of this nature indicates that the raw material at the time of canning was in poor condition. It is probable that similar results would be obtained with other flesh products. C. J. WEST

Quantitative study of the influence of sodium acetate, sodium borate, sodium citrate and sodium phosphate upon the activity of pancreatic amylase. H. C. SHERMAN, M. L. CALDWELL AND JANE E. DALE. *J. Am. Chem. Soc.* 49, 2596-8(1927).—The activity of pancreatic amylase in the presence of 0.05 *M* NaCl and under optimal conditions of H-ion activity is practically the same in the presence of equimol. concns. of citrate and phosphate. It is slightly lower in the presence of borate and acetate but this decrease in activity seems to be more probably due to less adequate control of H-ion activity in the less adequately buffered solns rather than to any sp. effect of the acetate or borate ions. When acting in the presence of 0.05 *M* NaCl and 0.004 *M* concns. of the Na salts of boric, citric and phosphoric acids for 0.5-hr. periods at 40° , pancreatic amylase exerts its optimum activity in solns. of p_{H} 7.0 to 7.2. In 0.05 *M* NaCl the activity of the enzyme appears to be independent of the concn. of phosphate from 0.0005 to 0.05 *M* and of borate from 0.001 to 0.01 *M*, provided the optimal conditions of H-ion activity are maintained. Given optimal H-ion activity, the activity of the enzyme appears to be practically the same in starch solns. contg. 0.05 *M* NaCl and no phosphate as it is in solns. contg. phosphate as well. Thus it seems improbable that these salts have any marked sp. effect upon the enzyme. C. J. WEST

The influence of physical training on the basal respiratory exchange, pulse rate and arterial blood pressure. I. C. SCHNEIDER, R. W. CLARKE AND G. C. RING. *Am. J. Physiol.* 81, 255-63(1927).—Basal metabolism declined with training in 3 subjects and was unchanged in 2 subjects. The basal min.-vol., frequency of breathing and early morning arterial pressure did not change with the condition of training; while the standing posture pulse rate was slower in the trained subject. J. F. LYMAN

Inorganic constituents of human saliva. II. G. W. CLARK AND LENA LEVINE. *Am. J. Physiol.* 81, 264-75(1927); cf. C. A. 21, 2723.—There was no constancy in salivary Ca, P, Cl and ash under regulated dietary conditions nor during fasting. Greater variations were noted in saliva activated by chewing paraffin than in resting saliva. Ingested Cl did not increase Cl in the saliva readily; but after the abnormal ingestion of inorg. phosphates a marked excretion of P was noted in the saliva. J. F. LYMAN

The effect of the parathyroid hormone on gastric secretion. II. The calcium content of gastric juice. W. C. AUSTIN AND S. A. MATTHEWS. *Am. J. Physiol.* 81, 552-9(1927).—The gastric response of the dog to histamine was normal after the administration of the parathyroid hormone, provided the H_2O balance of the body was maintained. After overdosing the dog with parathyroid hormone the Pavlov pouch continued to secrete until the beginning of hemorrhage, when it stopped suddenly and completely. The Ca content of pure gastric juice of the normal dog is 5 to 6.5 mg. in 100 cc. Parathyroid administration in amts. sufficient to raise the blood Ca to 18 or 19 mg. in 100 cc. had no marked effect on the Ca content of the gastric juice. J. F. LYMAN

The effect of carbon arc radiation on metabolism in the dog. H. S. MAYNARD. *Am. J. Physiol.* 81, 686-91(1927).—Dorsal exposure of a short-haired pigmented dog to

C arc radiation for 2 hrs. (110.88 g. cal. per sq. cm.) a day for 8 days, followed in 17 days by a second similar series of exposures, resulted in an increased N excretion and a rise in serum Ca and P. The immediate effect of exposure to C arc radiation may be a diln. of the blood resulting from the vasodilation and diffusion of H_2O from the tissues, which temporarily depresses its Ca and P content.

J. F. LYMAN

Spectrophotometric determinations of purified bilirubin. C. SHEARD, F. C. MANN AND J. L. BOLLMAN. *Am. J. Physiol.* **81**, 774-81 (1927).—Comparative tests (1) on the soly. of purified bilirubin and of the pigment of bile and blood of normal and jaundiced animals; (2) on the transmission of light by purified bilirubin and by the pigment of bile and blood serum; (3) on the effects of fading in these substances in soln.; and (4) on the applicability of the laws of Lambert and Beer to their solns. are cited as additional evidence that bilirubin and the pigment in question are identical.

J. F. LYMAN

Distribution of pancreatic secretin in the gastrointestinal tract. M. M. WEAVER. *Am. J. Physiol.* **82**, 106-11 (1927).—In the dog secretin was found in the gastrointestinal tract only, principally in the duodenum and the small intestine immediately ensuing and to a less extent in the stomach mucosa.

J. F. LYMAN

Exhaustion due to lack of sleep. I. Introduction and methods. T. H. BAST AND A. S. LOEVENHART. *Am. J. Physiol.* **82**, 121-6 (1927). II. Symptomatology in rabbits. C. LEAKE, J. A. GRAB AND M. J. SENN. *Ibid* 127-30. III. Effect on the nerve cells of the spinal cord. T. H. BAST, F. SCHACHT AND H. VANDERKAMP. *Ibid* 131-9. IV. Effects on the nerve cells in the medulla. T. H. BAST AND W. B. BLOEMENDAL. *Ibid* 140-6.

J. F. LYMAN

Simultaneous study of the constituents of the sweat, urine and blood, also gastric acidity and other manifestations resulting from sweating. III. Urea. G. A. TALBERT, J. R. FINKLE AND S. S. KATSUKI. *Am. J. Physiol.* **82**, 153-6 (1927); cf. C. A. **21**, 2482.—In 17 subjects urea N of the sweat varied from 0.24 to 1.12 mg. per cc.; in the urine, urea N varied from 0.82 to 27.6 mg. per cc.; while urea N of the blood was between 4.6 and 34.3 mg. per cc.

J. F. LYMAN

A theory of muscle contraction with x-ray diffraction patterns from relaxed and contracted muscles. JANET H. CLARK. *Am. J. Physiol.* **82**, 181-94 (1927).—The nature and extent of crystal in muscle fibers were studied by means of x-ray diffraction patterns, taken by the monochromatic pin-hole method. In the contracted muscle there was evidence of a true microcryst. condition. The distance between the equidistant mol. planes was 9.5 A. U. in the relaxed and 8.5 A. U. in the contracted state. It is probable therefore that this distance gives the width rather than the length of the mols. forming the equidistant planes.

J. F. LYMAN

The bile acids (SCHENCK, KIRCHHOFF) **10**. The activity coefficients of protein ions (ADAIR) **2**.

B—METHODS AND APPARATUS

STANLEY R. BENEDICT

A test for bile salts in urine. G. O. BROWN. *Proc. Soc. Exptl. Biol. Med.* **23**, 596-8 (1926).—Thirty cc. of urine, 30 cc. of 95% alc., 1 cc. of a 25% soln. of CCl_3COOH , and a small quantity of charcoal are boiled together, filtered, made alk. with NaOH and evapd. to a vol. of 15 cc. An equal vol. of normal H_2SO_4 is added; a cloudiness appears in the presence of bile salts.

C. V. B.

Method for equilibrating blood with frequently changing tensions of alveolar carbon dioxide. M. G. BANUS. *Am. J. Physiol.* **76**, 216 (1926).—In electrometric detn. of blood p_{H_2} it is necessary to know the CO_2 tension of the blood so that an equiv. CO_2 tension may be used in the electrode vessel. A sample of alveolar air is obtained by means of a special cannula inserted into the trachea. The CO_2 tension in this sample is detd. by Mariotte's colorimetric method, and at the same time a mixt. of H and CO_2 , prepd. from tanks by regulating 2 needle valves, is passed through another Mariotte tube until the color matches that of the sample.

J. B. BROWN

The isolation of secretin. J. MELLANBY. *J. Physiol.* **61**, xxxvii-xxxviii (1926).—The mucous membrane of the duodenum is ground up with 4 vols. abs. EtOH and filtered. The filtrate is evapd. to opalescence, diluted with 2 vols. H_2O , and acidified. The ppt., contg. no secretin, is filtered and to the filtrate is added 0.2% bile salt or Na cholate. The pptd. bile salt, contg. the secretin, is isolated by centrifugalization and purified by dissolving in the least possible amt. of 80% EtOH, the secretin being pptd. by the addn. of an equal vol. of acetone. Secretin is probably a polypeptide.

J. B. BROWN

The biological and therapeutic action of α -rays from radium— α -radium-therapy. M. A. BIOGLIO. *Arch. Radiologia* 1, Pt. V, 3-16(1925).—The construction of an app. for the utilization of α -rays therapeutically is described. A. W. CONTIERI

Leucine as supposed evidence of poisoning in the legal chemical examination of a corpse. G. JOACHIMOGLU AND A. OKATA. *Mitt. pharm. Ges.* 1925, 6 pp.; *Chem. Zentr.* 1926, II, 82.—It was possible to characterize the suspected substance, which was recovered from the alc. ext. of the liver, as leucine by synthesis with urea to the leucinuramino acid. C. C. DAVIS

Stain solubilities. II. W. C. HOLMES. *Stain Tech.* 2, 68-70(1927); cf. C. A. 21, 2143.—Data are given to show the unreliability of statements as to the soly. of any dye unless the dye tested is known to have been free from inorg. salts. The methods employed in the present work are outlined and a table of solubilities in H_2O and $EtOH$ of 23 dyes is included. The investigation is being continued. CARL R. FELLERS

Subsidiary dyes in methylene blue. W. C. HOLMES. *Stain Tech.* 2, 71-3(1927).—Suitable tests have been devised for the detection of azure B (trimethylthionine) and methylene blue. All samples of methylene blue examd. contain appreciable proportions of azure B. In view of the facility with which methylene blue undergoes oxidation, the synthesis of a thoroughly pure product is probably impossible, even with absolutely pure intermediates; and it may also be questioned if a complete purification of the crude product is practicable. CARL R. FELLERS

The preparation of vital neutral red. MAX PHILLIPS AND BARNETT COHEN. *Stain Tech.* 2, 74-9(1927); cf. C. A. 21, 1283.—Neutral red iodide suitable for vital staining was prepd. by condensing nitrosodimethylamine-HCl with *m*-tolylethylenediamine and the indamine, tolylene blue (I), was obtained. Air oxidation converted I to eurhodine, neutral red. This was purified by conversion into the relatively insol. $SnCl_2$ double salt, filtering, dissolving in H_2O and pptg. the neutral red iodide with KI. This was redissolved in H_2O , reprecipd. with KI soln. and crystd. from 95% $EtOH$. Other preps. of neutral red iodide were made. The chloride of the color base was prepd. by continuing the air oxidation of the tolylene blue until a test sample indicated its complete conversion into neutral red. The color was salted out with NaCl and crystd. from 95% $EtOH$. Both the crystd. and uncrystd. products were found to be excellent stains. CARL R. FELLERS

Staining with phloxin. C. J. CHAMBERLAIN. *Stain Tech.* 2, 91-3(1927).—A double stain with Magdala red (I) and aniline blue has given very discordant results. This is because of the variability in compn. of I. Standardized phloxin seems to be identical with successful lots of I and staining results are uniformly good. C. R. F.

Methods for demonstrating occult blood in the feces. FRITZ HIRSCHBERG. *Deut. med. Wochschr.* 53, 971-2(1927).—A discussion of the methods employed in demonstrating the presence of occult blood. ARTHUR GROLLMAN

A study of antimony trichloride as a possible quantitative reagent for vitamin A. F. WOKES AND S. G. WILLIMOT. *Analyst* 52, 515-24(1927).—The reaction between $SbCl_3$ and vitamin A was studied quantitatively. The reaction consists of a series of color changes: blue, yellow, red, with intermediate shades. The blue is probably characteristic of active vitamin. The reaction can be retarded, and therefore studied more closely, by adding $CHCl_3$ which has been dried over $CaCl_2$ to effect dehydration. The reaction between $SbCl_3$ and vitamin A is undoubtedly a chem. reaction and is probably a condensation. In applying the test the following suggestions are made: (a) Use as reagent a satd. soln. of pure $SbCl_3$ in anhyd. $CHCl_3$. Protect from the light and moisture. Decant off 2 cc. and put in a clean, dry 0.5-in. cell. (b) Prep. a soln. of the oil with anhyd. $CHCl_3$ on the day required and adjust the concn. so that 0.1-0.3 cc. is required. Mix this with the reagent by stirring with a clean, dry rod and note the time. (c) Take a tintometer reading in Lovibond blue units, 30 seconds after mixing. (d) Keep the temp. as near 16° as possible and correct for any temp. deviation of more than 1° by the chart shown. (e) Adjust the conditions so that the reading of blue units is below 18. W. T. H.

Determination of the blood volume. II. G. SCHIECK. *Klin. Wochschr.* 6, 945-6(1927).—Blood volume was detd. by the method of Seyderhelm and Lampe; but the values obtained were lower than those recorded by S. and L. Total blood vol. is 7% of the body wt.; plasma vol. is 3.4% of the body wt. MILTON HANKE

The significance of the titration of the gastric contents with two indicators after feeding a buffer-free test meal. LUDWIG HEILMEYER AND WALTHER GRAUBNER. *Klin. Wochschr.* 6, 1035-7(1927).—The old double titration method, with dimethyl yellow and phenolphthalein as indicators, is still the most significant as a diagnostic measure. Contents from a healthy stomach contain almost no buffering substances;

hence the titration curve is steep near the neutral point and the degree of acidity will be almost identical with either indicator. Bile, blood, mucus or substances derived from a carcinoma act as buffers and gastric juice contg. these substances will show a different titration value with each of the indicators. A divergence of 15 degrees of acidity, or more, is pathological.

Glycogen studies. ERICH BURGHARD AND HANS PAFFRATH. *Klin. Wochschr.* 6, 1479(1927).—The Pflüger method for detg. glycogen is seldom applicable to man because of the speed with which glycogen is converted into glucose by autolysis. This difficulty is overcome by detg. total carbohydrate by the method of Dische and Popper.

Congo red as a protein precipitant. ERNST MISLOWITZER. *Klin. Wochschr.* 6, 1240-1(1927).—Mix 3 cc. blood with 30 cc. H₂O and 10 cc. 3% Congo red. Add a few drops of satd. AlCl₃ soln. A copious flocculation occurs which contains all of the Congo red and all of the protein. The filtrate gives no ppt. with sulfosalicylic acid.

Determination of quinine by means of the potassium iodide-mercuric iodide reagent. B. ŠVEDSKIJ. *Surnal eksper. biol. mediciny* 4, 605-13(1927); *Ber ges. Physiol. experl. Pharmakol.* 40, 849.—In pure solns. the sensitiveness of the reaction is 1:200,000. In the ether ext. of the blood deductions must be made for substances which give the same reaction. Five min. after the injection of 0.5 g. quinine-HCl 82-95.2% have disappeared from the circulation.

Determining the minimal quantities of nicotine in the blood. A. S. SOKOLOV AND K. D. LYUBOVITZEVA. *Trans. Sci. Chem.-Pharm. Inst.* 1923, No. 3, 69-77.—Five cc. of blood to which definite amounts of nicotine were added was quickly transferred into a 200-250-cc. flask, which contained a boiling soln. of 25-30 cc. of H₂O and 2-3 drops of a 10% soln. of acetic acid. The flask was removed from the flame. 0.5 g. of soda and 4 g. NaCl were added and the contents steam-distd. 150 cc. were collected, evapd. in a porcelain dish on a water bath to a vol. not exceeding 25 cc. and tested with Lugol soln. for nicotine. The dilns. were carried out until no turbidity was observed. It was possible to detect nicotine in a diln. of 1:500,000.

Glycerol-potassium hydroxide solution in the microscopic investigation of blood traces. KARL MEIXNER. *Deut. Z. ges. gericht. Med.* 10, 253-5(1927).—With the aid of this soln. small traces of blood can be detected.

Total sugar of blood and urine. MARK E. EVERETT, HAROLD A. SHOEMAKER AND FAY SHEPPARD. *J. Biol. Chem.* 74, 739-59(1927).—The low values obtained in the detn. of total sugar by the Folin-Berglund hydrolysis method (*C. A.* 16, 2159) are due to the depressing effects of NaCl, formed during neutralization, and of silicates in the alkali used for neutralization on color formation. The use of 2.6 N H₂SO₄ and of silicate-free KOH as a general procedure for the detn. of total sugar by colorimetric methods is, therefore, recommended. Eight cc. of blood or urine filtrate are heated on a boiling H₂O bath for 75 min. (2½ hrs. with urine) with 1 cc. of 2.6 N H₂SO₄ in a specially designed 10-cc. volumetric flask, cooled and neutralized with 1 cc. of an equiv. silicate-free KOH soln. (kept in a paraffined bottle). The sugar content is then detd. by one of the well-known colorimetric methods (Folin-Wu, Benedict, Sumner or Folin). The data include glucose equivs. for known sugars and estns. of the destruction of sugar by acid and alkali. Higher values for total sugar than for free sugar are invariably obtained with this technic.

A micro-method for the quantitative determination of carbon dioxide in blood and other solutions, and some observations on the efficiency of paraffin oil as a means of keeping carbon dioxide in solution. DANIEL RAFFEL. *J. Biol. Chem.* 74, 839-49(1927).—The method is accurate for quantities between 0.1 and 0.5 cc. of CO₂ with an error not exceeding 1.1% and can be used with solns. of inorg. carbonates, blood serum and whole blood. The CO₂ is absorbed in Ba(OH)₂ soln. which is then titrated. Normal serum loses only 2% or less of its CO₂ in 24 hrs. when kept under paraffin oil but when large quantities are present the loss may amount to 10%.

Studies on urinary acidity and a method for electrometric titration of urine. SERGIUS MORGULIS AND W. R. HAMSA. *J. Biol. Chem.* 74, 851-61(1927).—Urine is titrated to a *p*_H of 7.4, the av. reaction of the blood, the end point being detd. by the quinhydrone electrode; one electrode is immersed in the known buffer soln. (*p*_H 7.4) and the other in the urine; the connection is made by an agar-KCl bridge and the urine is titrated until the potential difference, indicated by a galvanometer, disappears. The titration proceeds rapidly and is exceedingly sensitive, even a fraction of a drop being definitely registered by an oscillation of the galvanometer. The magnitude of the variation between the electrometric method and Folin's method of titration (to

a p_H of about 8.5) is a function of the p_H of the urine and the degree of discrepancy increases with the falling H-ion concn. of the urine. The cause of this increasing discrepancy may very well be the markedly high buffer value of urine above p_H 7.4; urines do not titrate like a mixt. of the pure substances concerned and must possess considerable buffer action which is independent of its phosphate, NH_3 , or org. acid content. At present no explanation of these high buffer values is offered but the suggestion is made that the buffer action may be assocd. with the colloidal properties of urine. Urine acidity detns., even when made by a reliable elec. method, have a limited significance and should, therefore, be regarded less as strictly quant. than as indications of the general trend of the metabolism of the organism. A. P. L.

Studies on methods. VII. LUDWIG PINCUSSEN. *Biochem. Z.* **186**, 28-35 (1927).—Description of a quinhydrone micro-electrode, a pipet for micro-analysis of blood gases, and a micro-titration app. S. MORGULIS

Studies on methods. VIII. LUDWIG PINCUSSEN. **The determination of the total sulfur in urine and in organs.** ARTHUR KONARSKY. *Biochem. Z.* **187**, 398-402 (1927).—A measured quantity of urine (usually 5-10 cc., but much smaller amts. in cases of cystinuria) is mixed with 1 g. $NaNO_3$ and 5 cc. of Benedict's oxidation reagent (200 g. $Cu(NO_3)_2$ and 50 g. $KClO_3$ in 1000 cc. H_2O) in a previously weighed centrifuge tube (made of resistant porcelain). This is evapd. carefully (the addn. of 1 cc. concd. HNO_3 is advisable but not essential) and gradually heated to red glowing, whereby the oxidation of org. matter is completed. After cooling 10 cc. HCl (1:4) is added and warmed until soln. is complete. To this is now added 5 cc. of warm 10% $BaCl_2$, and the ppt. is centrifuged after 2 hrs. The ppt. is then washed with H_2O and centrifuged until the supernatant liquid is Cl -free. The traces of water are evapd. and the tube is heated to redness. The tube is weighed and the gain in wt. $\times 0.1373$ gives the amt. of S in the $BaSO_4$ ppt. For the detn. of the total S of organs or various org. materials, this is first dried and powdered, a measured amt. of the powder being used for the analysis. The procedure is the same as for urine except that the preliminary evapn. is carried out with 1-2 cc. HNO_3 , and 10 cc. of Benedict's reagent is taken instead of 5 cc. S. MORGULIS

The differential calorimeter and the determination of the human basal metabolism. A. K. NOYONS. *Bull. assoc. hyg. aliment* **15**, 315-43 (1927).—After a review of the development of the differential principle in calorimetry, descriptions are given of the 3 models of differential calorimeters devised by N. for use with small (C. A. 19, 1875-6), medium-sized and large animals, with an explanation of the method of using them and a discussion showing that the results agree with those obtained by other methods. Bibliography of 37 references (since 1920). This is a summary of a more important work by N., published in English by René Fonteyn, Louvain, Belgium.

A. PAPINEAU-COUTURE

The determination of small quantities of bismuth in tissue, excreta, blood and bone. J. A. SULTZBERGER. *J. Am. Pharm. Assocn.* **16**, 218-21 (1927).—Digestion is accomplished by dry ashing over the Bunsen burner in Pyrex beakers or porcelain dishes. None of the Bi is lost at the temp. of the Bunsen burner, while the C is oxidized rapidly. No pptn. is necessary except in the analyses of bone, where the amt. of salts is too great for soln. in a small quantity of soln. The Bi is detd. colorimetrically in HCl soln. with an excess of KI . The liberation of free I by oxidation in the presence of Fe is prevented by the addn. of $NaHSO_3$. Chlorides do not interfere. L. E. WARREN

The osmometric method of determining the molecular weights of proteins. GILBERT ADAIR. *J. Am. Chem. Soc.* **49**, 2524-5 (1927).—Discussion of the recent work of Svedberg (C. A. 20, 1256, 21, 746), citing work of A. (C. A. 19, 2676, 3050) on the osmometric data for hemoglobin. C. J. WEST

A new instrument for measuring the cadaver heart gas. F. DYRENFURTH. *Deut. Z. ges. ger. Med.* **9**, 459-63 (1927).—The app. is described and sample detns. are given. FRANCES KRASNOW

Cadaver ash and questionable arsenic poisoning. GIERSE. *Deut. Z. ges. ger. Med.* **9**, 689-98 (1927).—Case report and discussion. FRANCES KRASNOW

The use of ultra-violet rays in forensic medicine. TETSUICHI ITO. *Deut. Z. ges. ger. Med.* **9**, 726-7 (1927).—I. gives the color effect of ultra-violet radiation on bone, hair, milk, urea, finger prints, seminal fluid stain, and blood stain. Use may be made of these effects in forensic procedure. FRANCES KRASNOW

The technic for the Uhlenhuth protein precipitin reaction. K. WALCHER. *Deut. Z. ges. ger. Med.* **9**, 728-9 (1927).—Brief discussion. FRANCES KRASNOW

The use of furfural as an embalming fluid. G. W. McNUTT and PAUL F. BRUNS. *J. Am. Vet. Med. Assoc.* **71**, 728-31 (1927).—Furfural is valuable when used in conjunc-

tion with other embalming agents. It controls molds, is not desiccating and is an excellent preserving medium for holding embalmed material until needed for dissection or other purposes.

FRANCES KRASNOW

The identification and differentiation of Fehling-reducing sugars in the urine by the Castellani-Taylor mycological method. PAOLO PIETRA. *J. Trop. Med.* 30, 182-4 (1927).—See C. A. 21, 2144.

FRANCES KRASNOW

The reagents for medicinal examinations in the German Pharmacopeia, 6th ed., and their practical applications. G. HEYL. *Apoth. Ztg.* 1927, Nos. 2 and 5; *Schweiz. Apoth. Ztg.* 65, 97-104, 109-11 (1927).—This article is a concise treatise on the examn. of urine, stomach contents and blood. In each case the reagents are given, and the mode of using these in carrying out the tests.

S. WALDBOTT

The technic and interpretation of the van den Bergh test; its value in detecting latent jaundice. R. E. STEEN. *Irish J. Med. Sci.*, 6th series, No. 21, 573-82 (1927).—A modified technic is described. The diazo reagent is composed of 2 solns.: Soln. A contains sulfanilic acid 1 g., concd. HCl 15 cc. and distd. H₂O 1000 cc. Soln. B contains NaNO₂ 0.5 g. and distd. H₂O 100 cc. The diazo reagent consists of 5 cc. of A and 0.15 cc. of B mixed thoroughly and prepd. fresh each time. *Technic of the "direct" test.*—To 0.5 cc. serum an equal quantity of diazo reagent is added. If a red color develops within 1 min. there is "hepatic bilirubin" in the serum; if the color of the serum remains unchanged, either "hepatic bilirubin" is absent, the normal amt. of "non-hepatic bilirubin" being present, or an abnormally great quantity of this bilirubin is present and will be shown by a color change in the "indirect" test. *Technic of the "indirect" test.*—To 1 cc. of the original serum, 2 cc. of 96% alc. are added and the mixt. is shaken and centrifuged. To 1 cc. of the supernatant fluid is added 0.25 cc. of the diazo reagent. A violet color is formed quickly, but takes some time to deepen, in milder reactions. Both types of bilirubin give an "indirect" reaction; only "hepatic bilirubin" gives the "direct" reaction. The "direct" reaction is positive when a pink or red color develops in the serum within 1 min. If such color develops within 2 min. and the "indirect" test is not strongly positive, one may suspect an old serum or a minute quantity of "hepatic bilirubin." In the "direct" test a subsequent deepening of the color occurs whether non-hepatic bilirubin is present or not. Accordingly, the van den Bergh reaction cannot be used to distinguish between catarrhal and toxic jaundice. Sera to be tested should not be exposed to direct sunlight for any length of time. The "direct" test is of great practical value in detecting latent obstructive jaundice, i. e., cases where a very tiny quantity of bilirubin has been absorbed from the ducts, and is insufficient to color the skin or mucous membranes, or produce biliuria.

R. C. WILLSON

Estimation of CO₂ and of carbonates in solution. Application to the determination of CO₂ in body fluids (NICLOUX) 7.

Shadow-producing composition for use in medical radiography. B. RAPP. U. S. 1,644,446, Oct. 4. BaSO₄ 100 is used with sucrose 12.5 parts and gum tragacanth. A special method of prep. the mixt. is described.

C--BACTERIOLOGY

A. K. BALLS

Further studies on staphylococcus bacteriophage. BESSIE R. CALLOW. *J. Infectious Diseases* 41, 124-36 (1927).—C. passed a staphylococcus suspension in distd. H₂O through a Berkefeld filter and obtained a bacteriophage free from broth constituents and which did not give any protein color tests. The addn. of several salts in a concn. greater than 0.01 M proved injurious to the bacteriophage, the activity of which decreased as the valence of the anion or cation of the salt increased. Heat at 60° for 1/2 hr. destroyed the bacteriophage. Kaolin and alumina cream adsorbed the bacteriophage.

PAUL R. CANNON

Pyruvic acid and methylglyoxal as intermediate products of lactic acid fermentation. S. KOSRYCHEV AND S. SOLDATENKOV. *Z. physiol. Chem.* 168, 124-7 (1927).—A culture medium consisting of whey, peptone, NaCl and CaCO₃ was inoculated with *Bact. caucasicum*. During the first 3 days NH₂NHCONH₂·HCl was added in small portions. At the end of 14 days the mixt. was boiled and filtered, treated with (CO₂H)₂ to remove Ca evapd. *in vacuo*, and extd. with Et₂O to remove lactic acid. A cryst. ppt. was finally obtained which was sepd. into 2 fractions by crystn. These were identified as the semicarbazone of AcCO₂H and the disemicarbazone of AcCHO.

A. W. DOX

Alcohol fermentation. XII. Methylglyoxal as an intermediate product of alcoholic

yeast fermentation. S. KOSTYCHEV AND S. SOLDATENKOV. *Z. physiol. Chem.* **168**, 128-31 (1927); cf. C. A. **21**, 3206.—Cf. preceding abstr. By fermenting sucrose in the presence of $\text{NH}_2\text{NHCONH}_2 \cdot \text{HCl}$, then boiling, filtering and evapg. the product, crystals of AcCHO -disemicarbazone were obtained and identified. The semicarbazone of AcCO_2H was not obtained in this expt., although it was probably present. These are the first satisfactory demonstrations of the formation of AcCHO in biol. processes. A. W. DOX

Variability of the Gram reaction. H. J. CONN, *et al.* *Stain Tech.* **2**, 80-7 (1927).—Slides were prepd. bearing smears of 6 different organisms known to differ widely in their behavior to the Gram reaction. A single technician prepd. 120 such slides and distributed them to 10 collaborators with identical directions. In 4 of 6 cultures all 10 collaborators gave consistent reports. The other 2 cultures proved so variable in their reaction toward the staining method that it is impossible to consider them either Gram-positive or Gram-negative. Such organisms must be regarded as belonging to an intermediate group, and should be called *Gram-variable*. This work strengthens the theory that there is a definite relationship between the Gram reaction and the isoelectric point of the bacteria. CARL R. FELLERS

Examination of halophilic microorganisms. WM. CLAYTON AND W. E. GIBBS. *Analyst* **52**, 395-7 (1927).—"Pink" on salt cod fish and "salt stains" on hides may be produced as a result of curing with solar salt. It must be admitted that there are microorganisms which can only exist and develop in the presence of considerable amts. of NaCl and these so-called halophilic stains have not been studied much. The prepn. of chromogenic and non-chromogenic stains of this nature is described in detail. W. T. H.

Physicochemical study of specific constituents of bacteria. I. Differentiation between Bruce's micrococcus and B. Bang. EGIDIO VALENTI. *Biochim. terap. sper.* **14**, 77-115 (1927).—Expts. with 55 strains of *B. Bang* (*B. abortu* Bang) (I) and 44 strains of *B. melitense* (Bruce) (II) gave the following results: Heating (100°) either alone or in the presence of 0.1 *N* HCl does not permit a differentiation; I is always resistant, II only in a certain percentage of cases. Delipoidation by heat offers a reliable method of differentiation. The suspension of a 48 hr. agar culture in 12-14 cc. 0.1 *N* NaCl is heated 30-60 min. at 100° , then shaken out with an equal vol. of ether. After this treatment (I) always gave a distinct pptn. with all concns. of sp. serum, II gave either no agglutination or only with the stronger serum dilus. This loss of sp. agglutination suggests a profound change in the chem. nature of the component responsible for the reaction. The differentiation can be made with I serum only, since II serum agglutinates almost all I strains. MARY JACOBSEN

Thermophilic species of *Penicillium arenarium* nov. sp. producing citric acid. V. SHAPOSHNIKOV AND A. YA. MANTEIFEL. *Trans. Sci. Chem.-Pharm. Inst.* **1923**, No. 5, 3-27.—Morphologic and physiologic characters of a new species of *Penicillium* producing citric acid at a temp. of 40° are given. The compn. of the medium and the influence of various substances on the growth of the fungus are described. J. S. JOFFE

Physiology of *Penicillium arenarium* in connection with citric fermentation. V. SHAPOSHNIKOV AND A. YA. MANTEIFEL. *Trans. Sci. Chem.-Pharm. Inst.* **1923**, No. 5, 28-56.—A more extensive study of the organism (cf. preceding abstract). J. S. J.

The biological significance of the citric acid fermentation. V. SHAPOSHNIKOV. *Trans. Sci. Chem.-Pharm. Inst.* **1923**, No. 5, 57-64.—A theoretical discussion. J. S. J.

The bactericidal action of the commoner phenols and of some of their derivatives on *Bacillus pestis*. J. F. CAIUS, B. P. B. NAIDU AND SHAMSHER JANG. *Indian J. Med. Research* **15**, 117-34 (1927).—The substances studied fell within four main groups: (1) the phenols; (2) derivs. of phenols; (3) the phthaleins and (4) derivs. of fluorescein. A comparatively high activity was manifested by hydroquinone (1:432,000), mercurochrome-220-sol. (1:76,800), pyrocatechol (1:48,000), α -nitroso- β -naphthol (1:25,600), toluhydroquinone (1:14,400), 2,4-diaminophenol (1:10,000), carvacrol (1:11,200), and 2,4,6-trichlorophenol. The phthalein dyes show relatively small bactericidal value. FRANCES KRASNOW

A note on nutrient broth now used for the culture of *Bacillus pestis* and its hydrogen-ion concentration. B. P. B. NAIDU AND SHAMSHER JANG. *Indian J. Med. Research* **15**, 135-9 (1927).—The p_{H} of the broth of 100 samples was between 6.6 and 7.4 and in 85 cases between 6.6 and 7.0. The most favorable immunity is obtained by using the vaccine from broth, the initial p_{H} of which was 6.8. 175 rats were used. FRANCES KRASNOW

A comparative studying of staining methods for demonstration of spirochetes.

K. YASUYAMA. *J. Philippine Islands Med. Assoc.* 7, 215-7(1927).—Fontana's method is superior to any other method for staining spirochetes and is the most practical one, because it is simple and quick. It gives excellent results in 15 min. F. K.

The separation of lipid fractions from tubercle bacilli. R. J. ANDERSON. *J. Biol. Chem.* 74, 525-35(1927).—The lipids were extd. from moist, living tubercle bacilli at room temp. with a mixt. of alc. and Et₂O followed by extn. with CHCl₃. To prevent oxidation, air was rigidly excluded by using an atm. of CO₂. Three fractions were thus obtained consisting of glycerides, phosphatides, and wax, the wax constituting more than 1/2 of the total lipoids. Over 2000 cultures were used, each culture contg. on an av. a little less than 2 g. of dry bacteria and the total lipid material representing 23.78% of the dry bacilli. The following amts. of lipid fractions and other compds. were obtained: 1st phosphatide 148.5 g., 2nd phosphatide 104.6 g., Me₂CO-sol. fat 240 g., CHCl₃-sol. wax 427 g., base pptd. by HgCl₂ 7.2 g., base pptd. by phosphotungstic acid 5.3 g., polysaccharide 33.9 g., dried bacterial residue 2902 g., total 3868.5 g. The polysaccharide in the pure state is quite insol. in alc. and Et₂O and was present in the ext. probably by reason of the H₂O contributed by the fresh bacteria to the alc.-Et₂O mixt.; it could be pptd. from aq. soln. by alk. basic Pb acetate. **A study of the phosphatide fraction of tubercle bacilli.** *Ibid* 537-51. —After elimination of 58.6 g. of wax from the 2nd phosphatide fraction (cf. above) by several repts. and the purification of the 1st phosphatide, the compn. of the 2 fractions was found to be practically identical, the combined fractions amounting to 194.5 g. or somewhat more than 5% of the dry bacilli. The purified first fraction was hydrolyzed and a study made of its cleavage products. As a result of this study and the actual isolation of the different cleavage products its compn. may be calcd. to be as follows, per 100 parts of the phosphatide: palmitic acid 30.5, oleic acid after reduction to stearic 12.8, liquid satd. fatty acid 20.9, glucose 13.9, sugar acid 13.8, glycerophosphoric acid 5.4 parts. The total value is low because of inevitable losses in the sepn. of the compds. especially the fatty acids. The nature of the satd. liquid fatty acid and the sugar acid is still unknown. The carbohydrate complex is combined in such a manner in the phosphatide mol. that reduction of Fehling's soln. occurs only after hydrolysis. Practically all the N in the phosphatide can be distd. off in the form of NH₃ in the presence of dil. alkali and as only about 0.3% of N is present, it appears probable that NH₃ is the only N-contg. base present and that it is probably bound on the phosphoric acid. Air was excluded in all operations as completely as possible by using an atm. of CO₂. A. P. LOTHROP

The nitrogen content of aspergillin. AUGUST RIPPEL AND KURT WALTER. *Biochem. Z.* 186, 474-7(1927).—Aspergillin is the amorphous black coloring matter in the spores of *A. niger*. The alc.-sol. fraction of this substance contains 3.3%, the alk.-sol. fraction approx. 4.3% N, which is uninfluenced by the N content of the nutrient medium. S. MORGULIS

The enzymic metabolism of bacteria. IV. The use of biological glucose determination. P. RONA, D. NACHMANSOHN AND H. W. NICOLAI. *Biochem. Z.* 187, 328-43(1927).—The fact that *B. coli* does not split sucrose or maltose under anaerobic conditions while it decomposes their split products with the formation of acid is utilized as a basis for the gasometric detn. of hexose. With Warburg's app., the CO₂ set free from the NaHCO₃ by the acid thus produced serves as a measure of the hexose production. This is further applied to the study of sucrase and maltase activity as well as of amylase. S. MORGULIS

Studies on the cultivation of Bacillus influenzae (Bacillus of Pfeiffer) on synthetic media. GOTTFRIED PETRAN. *Centr. Bakt. Parasitenk. I Abt.* 103, 29-38(1927).—When the reaction is adjusted with Na₂CO₃, *B. influenzae* needs (along with X and V substances) Na, PO₄ and, as a source of N, NH₃. Asparagine is not well utilized. If the medium is protein-free, degeneration forms occur. This is prevented by a trace of peptone, *l*-tyrosine, or *l*-cystine. *l*-Leucine is slightly utilized, and tryptophan and *d*-alanine not at all. JOHN T. MYERS

The fat metabolism of skin fungi. I. The fat-splitting powers of living fungus cultures. ASTA V. MALLINKRODT-HAUPT. *Centr. Bakt. Parasitenk. I Abt.* 103, 73-87(1927).—In general, *Hyphomycetes* seem to utilize low m. p. fats best. Tributyrin is not as good as triolein, but better than tristearin or tripalmitin. Vegetable oils permitted very little growth. JOHN T. MYERS

The differential diagnostic value and technic of the catalase reaction. M. KNORR. *Centr. Bakt. Parasitenk. I Abt.* 103, 147-51(1927).—The catalase reaction is of value in identifying organisms. JOHN T. MYERS

The theory of the Gram stain. GEO. KALINA. *Centr. Bakt. Parasitenk. I Abt.*

103, 172-6(1927).—In Gram-positive organisms the I reacts only with the ectoplasm, while in Gram-negative organisms it reacts with the deeper cell substance and the resulting granules resist the action of a solvent. JOHN T. MYERS

The value of cystine in growing the diphtheria bacillus. H. BRAUN AND F. R. MUNDELL. *Centr. Bakt. Parasitenk. I Abt.* 103, 182-4(1927).—The addn. of 0.0125% of cystine to Loeffler's medium hastens the growth of the diphtheria bacillus. JOHN T. MYERS

The influence of sodium chloride on the formation of involution forms of spore-forming bacteria. P. P. SMIRNOFF. *Centr. Bakt. Parasitenk. II Abt.* 70, 29-36(1927).—A concn. of 2.5% NaCl in media caused *B. alvei* to grow as shorter wider cells. A greater concentration prevented cell division, producing filaments with a normal diameter. A concn. of NaOH between N/150 and N/300 produced small involution forms. The same concn. of HCl produced large involution forms. J. T. M.

Fat- and wax-splitting fungi. HEINRICH ZIKES. *Centr. Bakt. Parasitenk. II Abt.* 69, 161-3(1926).—Pure fats and waxes do not support the growth of fungi. Positive results in the past were probably due to adherent traces of proteins and carbohydrates. JOHN T. MYERS

The influence of variations in atmospheric conditions on the growth and fermenting powers of yeast. H. ZIKES AND F. WAGNER. *Centr. Bakt. Parasitenk. II Abt.* 70, 193-202(1927).—The speed of fermentation by yeasts is related to the atmospheric conditions in the container, such as the presence of ordinary air, N, air washed with H_2SO_4 , or the use of a valve to permit escape and prevent entrance of gases. The total amt. of fermentation did not depend on these factors but on the inherent fermenting powers of each species. JOHN T. MYERS

The iron bacteria of the Gallionella group. KARL SUESSENGUTH. *Centr. Bakt. Parasitenk. II Abt.* 69, 327-39(1927). JOHN T. MYERS

The synthetic action of bacterial lipases. N. VAN DER VALLE. *Centr. Bakt. Parasitenk. II Abt.* 70, 369-73(1927).—*B. pyocyaneus* produces a lipase capable of combining fatty acids with propyl, isobutyl, amyl, hexyl and octyl alcs; methyl- and nonyl-carbinol; and glycerol. The reaction is slow with methyl, ethyl and benzyl alcs. and *nil* with ethylene glycol. It was very slow with AcH and methyl, ethyl and amyl alcs., and glycerol and *nil* with butyric acid and glycerol. The staphylococcus yields an enzyme capable of causing fatty acids to combine with glycerol but not with amyl alc. *B. prodigiosus* will cause fatty acids and glycerol to combine. *B. coli* and *B. dysenteriae* produced no synthetic lipase. JOHN T. MYERS

The influence of high salt concentration on bacteria from the Liman estuary at Odessa. M. A. BARANIK-PIKOWSKY. *Centr. Bakt. Parasitenk. II Abt.* 70, 373-83(1927).—At the highest salt concn. of the Liman water, 25° to 26° Baumé, some bacteria can grow and split protein with the formation of NH_3 and H_2S ; at greater concns., growth was slowed. Three species were isolated which would grow in water satd. with sea salt. The max concn. for NaCl is less, H_2S production stops at 20% and NH_3 at 25%. The size and form of the cells differ with varying salt concns. JOHN T. MYERS

A type of urea-splitting bacterium found in the human intestinal tract. J. V. COOKE AND HAZEL REED KEITH. *J. Bact.* 13, 315-9(1927).—The characteristics are described of a microorganism commonly found in the intestinal tract of infants and older children, and having exceptional power of splitting NH_3 from urea. The name *Bact. ammoniagenes* is suggested. JOHN T. MYERS

Studies on the aerobic bacteria commonly concerned in the decomposition of cellulose. L. A. BRADLEY AND L. F. RETTGER. *J. Bact.* 13, 321-45(1927).—Cellulose-decompg. organisms are closely associated with decaying vegetable matter. The fermentation reactions of the group suggest a means of strain differentiation. The presence of a buffer increases the amt. of cellulose decompn. The presence of cellulase may be demonstrated by the auxanographic method on cellulose casein-digest agar. A long bibliography is appended. JOHN T. MYERS

Interfacial surface tension and bacterial growth. NEAL DAVIS. *J. Bact.* 13, 381-6(1927).—If bacteria are looked upon as analogous to oil drops, both the stimulating and the toxic effects of cations can be explained. JOHN T. MYERS

The relation of surface tension to bacterial development. O. R. PIZARRO. *J. Bact.* 13, 387-408(1927).—Inhibition of bacterial growth was due to the chem. nature of the depressant rather than to decreased surface tension. JOHN T. MYERS

The diffusion products of bacterial cells as influenced by the presence of various electrolytes. H. J. SHAUGHNESSY AND C. E. A. WINSLOW. *J. Bact.* 14, 69-99(1927).—In addn. to direct absorption of H or OH ions, bacterial cells exert a distinct influence

upon the reaction of the menstruum. This involves the liberation of acids in alk. media and of alk. substances in acid media. With *B. coli* the ultimate p_{H} approximates 6.2-6.4. This is apparently an adaptive reaction. On prolonged exposure to a somewhat unfavorable medium, *B. cereus* will liberate so much NH_3 that the medium becomes alk. and the cells die. The cells of both *B. coli* and *B. cereus* are relatively impermeable to Cl, Ca and PO_4 ions, but allow the free passage of CO_2 and NH_3 and these produce the effects on the menstruum. In general the wall of *B. cereus* is more permeable than that of *B. coli*. Dil. solns. of NaCl (0.145 M) tend to increase cell wall permeability. A strong soln. of NaCl (1.450 M) and CaCl_2 of moderate strength (0.0145 and 0.1450) decrease permeability to alkali and increase it for acid. The strong Ca soln. shows with *B. coli* a sharp initial rise in titratable alk. and acidity followed by a fall probably due to decrease in permeability leading to lysis with liberation of protein followed by an accumulation of non-reactive films on the particles, or absorption of oppositely charged ions.

JOHN T. MYERS

The influence of carbon dioxide on bacteria. GEORGE VALLEY and LEO F. RETTGER. *J. Bact.* 14, 101-37(1927); cf. *C. A.* 20, 2870.—Removal of CO_2 from an environment otherwise favorable to development stops bacterial growth completely. The addn. of 0.03% of CO_2 often stimulates growth. CO_2 is necessary to the growth and development of the bacterial cell. There is a long bibliography.

J. T. M.

Color diffusion in Endo agar. ELIZABETH F. GENUING and LUCY E. THOMPSON. *J. Bact.* 14, 139-56(1927).—The reaction should never be more acid than p_{H} 7.4. Na_2SO_3 is much more satisfactory than NaHSO_3 . Exposure to light is negligible. Fuchsin should be tested for its ability to be decolorized by Na_2SO_3 .

JOHN T. MYERS

Studies of selective bactericidal action. E. A. COOPER and JOHN MASON. *J. Hyg.* 26, 118-6(1927).—Germicides can be divided into 2 classes, chem., those which react with protoplasmic constituents; and physico-chem., those which ppt. cell proteins. *B. fluorescens non-liquifaciens* and related organisms are selectively attacked by physico-chem. germicides as phenol, while *B. coli* is less sensitive to them but more to chem. germicides as the quinones. Hot water, alcs. and phenols all react in a similar manner, *B. coli* being less sensitive than *B. fluorescens*. Substitution of various groups into the benzene ring in the case of the aromatic disinfectants affects the germicidal power on *B. coli* and *B. fluor. non-liq* unequally, with the result that the selective action may be obscured or even reversed. Selective action is not affected by temp., period of disinfection, nature of the culture medium, no. of bacteria present, or the phys. state of the disinfectant.

JOHN T. MYERS

The use of hypochlorites as a sterilizing agent for dairy utensils. W. A. HOY and JANET R. L. RENNIE. *J. Hyg.* 26, 127-31(1927).—There is danger that Cl will be added to the milk or the vessels to be recontaminated by the much washing necessary to remove it.

JOHN T. MYERS

A new method of preparing staphylococcal hemolysin. J. W. BIGGER. *J. Path. Bact.* 30, 271-6(1927).—Staphylococcal hemolysin may be prepd. by suspending staphylococci from a solid medium in isotonic NaCl soln and freeing the fluid from cocci by centrifuging, leaving the purest lysin yet obtained. It is thermostable, the titer being reduced only one half by 100° for 30 min. It can be dried by evaporation and retains its activity for months. It is insol. in alc., ether, CHCl_3 , or acetone. It acts best in a slightly alk. medium. No definite antibody has been produced.

J. T. M.

The influence of cultural conditions on the production of diphtheria toxin. A. F. WATSON and ELSIE LANGSTAFF. *J. Path. Bact.* 30, 383-413(1927).—Growth-promoting "substances" are to be distinguished from toxin-inducing "substances." Both are preserved if sterilization is carried out by filtration through a Seitz press followed by a short steaming.

JOHN T. MYERS

The titration of bacteriophage and the particulate hypothesis. H. CLARK. *J. Gen. Physiol.* 11, 71-81(1927).—The theory of the serial diln. method for the titration of bacteriophage has been worked out on the assumption that the presence of one or more particles of bacteriophage in any tube always results in the dissolution of the bacteria, and that the particles are not dissociated, coalesced, adsorbed or otherwise lost during the process of diln. When the diln. const. is 0.1 it is shown that only about 60% of parallel runs on the same soln. should give the same end-point. In actual experience an est. of 85% has been obtained. No explanation of the discrepancy is offered.

C. H. R.

Physiologic significance of ethylenic linkages of fatty acids. EMILÉ F. TERROINE, R. BONNET, G. KOPP and J. VÉCHOT. *Bull. soc. chim. biol.* 9, 605-19(1927).—Cultures of *S. nigra* and of *B. de la Fléole* showed a relation between high temp. and the production of satd. acids and low temp. and unsatd. acids production. The rate of growth

of *S. nigra* is slow on the fatty acids of butter (I index 33) and rapid on the fatty acids of linseed oil (I index 180). The formation of satd. fatty acids at the expense of glucose by *S. nigra* and *B. de la Fléole* requires a greater expenditure of energy than does the formation of unsatd. acids. The formation of satd. fatty acids is not only the proof but the consequence of a greater activity of the vital processes. L. W. R.

Mechanism of action of aliphatic acids, particularly the non-saturated acids and their soaps, on bacteria and toxins. P. SEDALLIAN AND L. VELLUZ. *Bull. soc. chim. biol.* 9, 824-36(1927); cf. C. A. 21, 3677.—The object of this study was to learn the mechanism of inactivation of toxins by the soaps (cryptotoxins). Expts. were made with tetanus toxin neutralized by appropriate quantities of soaps of the satd. acids (lauric, palmitic, stearic) and the unsatd. acids (crotonic, dimethylacrylic, undecylenic, oleic, linolenic and ricinoleic). Surface tension changes do not suffice to explain the neutralizing power of the soaps. The adsorption of the soap by the micellae of the toxin appears necessary but not sufficient. The inactivation is accentuated by the presence in the soap mol. of ethylenic linkages and an alc. hydroxyl. The insolv. of the acids corresponding to the soaps, and their spreading force, appear to be concerned in the mechanism of inactivation. These same factors are believed to influence the formation of cryptotoxins and the inhibition of diastases. L. W. R.

Autoelimination of ammonia in cultures of microorganisms. A. BERTHELOT AND (Mlle.) G. AMOUREUX. *Bull. soc. chim. biol.* 9, 932-4(1927).—The object of this study was to learn the quant. relation which exists in cultures during the autopptn. of ammonia. Cultures of *Proteus vulgaris* were made in sterilized peptonated water 1.5%. Some of the cultures were modified by the addn. of 1.3% $MgSO_4$, 0.566 Na_2HPO_4 and 0.433 KH_2PO_4 . At the beginning the p_H of the cultures was 6.8. After 15 days at 37° the p_H of the controls was 8.0, while that of the modified cultures was 6.0. These cultures were allowed to remain in the thermostat for 4 months, then at lab. temp. 4 months when the crystals of NH_4MgPO_4 were filtered out and weighed and the NH_3 and amino acids in the filtrate were detd. The NH_3 pptd. in the control culture was 0.007 g. per l., that in the modified culture was 0.795 g. Thus the autopptn. of NH_3 prevents the culture from becoming too alk. for the growth of the organism. L. W. RIGGS

Physico-chemical antagonism of bacteria. C. ARNAUDI, W. KOPACZEWSKI AND M. ROSNOWSKI. *Compt. rend.* 185, 153-6(1927).—The conditions of surface tension, p_H , and elec. cond. of media in which certain bacteria show antagonism were studied. General conclusions did not appear to be warranted by the results. L. W. RIGGS

Filtrable elements of tuberculous virus. (Mlle.) A. TOGUONNOFF. *Compt. rend. soc. biol.* 97, 349-51(1927).—Cultures of Koch bacilli whether virulent or not may contain filtrable elements which pass the Chamberland filters. These filtrable elements cause, in exceptional cases only, the sp. nodular lesions in the guinea pig in which they are inoculated. L. W. RIGGS

Influence of acetone on the development and chemical composition of bacteria. ALBERT BERTHELOT, (Mme.) St. DANYSZ-MICHEL, (Mlle.) E. OSSART AND G. AMOUREUX. *Compt. rend. soc. biol.* 97, 437-8(1927).—Ten species of the more common pathogenic bacteria were developed in cultures contg. from 2 to 5 vol. % acetone. Of these *B. subtilis*, *B. coli* and staphylococci were subjected to 8 passages in 4 days in acetone bouillon at the optimum for each, after which they could be cultivated in acetone bouillon contg., resp., 2, 3/2 and 1/66 times as much acetone as at first. Cultivation of *B. subtilis* in water-peptone-acetone increases its sugar content. L. W. RIGGS

Germicidal power of ethyl alcohol in spirits. B. B. BRAHMACHARI. *Indian Med. Gaz.* 62, 384-5(1927).—In distilleries spirits are dild. with water which is freely open to contamination. Tests proved that *V. cholerae* cannot live for more than 4 hrs. in 11.8% alc. or more than 1 day in 7.8% alc. *Bacillus typhosus* is more resistant but does not survive 11.48% alc. for more than 1 day. Dysentery bacilli disappear from 15.75% alc. in 4 hrs. L. W. RIGGS

The production of certain enzymes by *Bacterium pruni*. S. I. JODIDI. *J. Agr. Research* 35, 219-21(1927).—Proteolytic and lipolytic enzymes have been shown to be present among the products of growth of *Bacterium pruni* in milk. W. H. ROSS

Sulfur metabolism of yeast. H. SUGATA AND F. C. KOCH. *Plant Physiology* 1, 337-47(1926).—Various forms and amts. of S were added to an artificial culture medium contg. known, but very small quantities of S, and the rate of growth of yeast was detd. Mg and sulfate were found to be equally important in yeast growth. The inorg. sulfate form proved the most available. Sulfate-S is converted into yeast protein and probably at least in part into cystine. Cystine, cysteine and H_2S stimulate yeast

growth in a sulfate-free medium up to certain, but low concns. Above these concns. they retard growth. Yeast growing in a sulfate-free medium contg. cystine as the source of S converts part of the cystine into new yeast protoplasm and about an equal amt. into sulfate left in the medium. The effects of taurocholic acid, cysteinic acid and taurine are also reported.

WALTER THOMAS

The use of certain carbohydrates and glucosides in the differentiation of members of the Salmonella group of food-poisoning bacilli. FRANK WOKES AND J. H. IRWIN. *Pharm. J.* **118**, 747-51; *Chemist & Druggist* **107**, 37-9 (1927).—Of the Salmonella group of food-poisoning bacilli, 21 members have been examd. both in regard to their action on the animal, and by chem. reactions, with a view to evolving new biochem. methods of identification. Immune sera were prepd. of specially high titer, and by means of these, serological classification was worked out. Using this as a basis, the bacterial enzyme action of the organisms was examd. on a series of 24 alcs., carbohydrates and glucosides. Of these, the most useful results were obtained with arabinose, xylose, sorbitol, mannitol, dulcitol, mannose, sucrose and maltose. Of the glucosides, arbutin showed the greatest differentiation. Esculin and salicin gave the same results, and amygdalin and phlorluzin were not acted upon.

S. WALDBOTT

Soluble specific substance of Friedländer's bacillus. III. Isolation and properties of the specific carbohydrates from Types A and C of Friedländer bacillus. W. F. GOEBEL AND O. T. AVERY. *J. Exptl. Med.* **46**, 601-7 (1927); cf. *C. A.* **20**, 614; **21**, 3646.—Cultures of Type A Friedländer bacillus, digested with a sterile soln. of purified trypsin, pptd. with AcONa and EtOH and the ppt. of impure carbohydrate purified by pptn. from aq. soln. with 2 vols. EtOH (5-6 times), the soln. (500 cc.), treated with 50 cc. 1.1 HCl, dialyzed, concd. to 200 cc., treated with 400 cc. AcOH, the filtered soln. concd. and poured into 10 vols. Me₂CO contg. a little HCl, gives a practically N-free, amorphous powder, with α_D from -100° to -105° , acid equiv. 430-445, contains no ash, 43.98% C and 6.00% H and gives 64-68% reducing sugars on hydrolysis (as glucose). Acid hydrolysis gives a reducing soln. which shows a strong naphthoresorcinol test (glucuronic acid or an isomer). The similar product from Type C bacillus has α_D 100° , an acid equiv. of 680, gives about 75% of reducing sugar (the larger part of which is glucose, isolated as the osazone); it also contains glucuronic acid. In both instances sp. function and carbohydrate are apparently inseparable.

C. J. WEST

Effect of serum upon the germicidal action of soaps. A. H. EGGERTH. *J. Exptl. Med.* **46**, 671-88 (1927).—By detg. the germicidal titers over a wide range of p_H a characteristic curve for each test substance is obtained. The curve for a particular concn. of serum bears a definite relationship to the curve for salt soln. (buffer) alone. Wherever the titer in salt soln. is high, very small quantities of serum greatly diminish that titer. If the titer in salt soln. is low, small quantities of serum leave the titer unchanged. Thus small addns. of serum flatten the curves and make them more nearly horizontal. If further large amts. of serum are added, a further reduction in titer takes place at all reactions. The Ca of serum has only a very slight effect upon the soap titer; the protein is probably inhibitory to soaps but the curve for partially defatted serum and those for other protein substances tested do not run parallel to the serum soap curves. The various lipoids that are known to be present in serum are inhibitory to the action of soaps, both as emulsions and as clear solns. The action of serum upon soaps may be regarded as a complex reaction, in which lipoids, protein, and, to a lesser extent, Ca salts take part. Their effect is due to the fact that these substances, by combining with the soaps, remove them from the field of germicidal action.

C. J. WEST

Researches on the formation of diastase by *Aspergillus niger*. G. L. FUNKE. *Rec. trav. botan. neerland.* **23**, 200-44 (1926); *Ber. ges. Physiol. exptl. Pharmacol.* **39**, 736.—The growth of *Aspergillus niger* and the formation of amylase are inhibited by the brown substances formed from reducing sugars on sterilization in the presence of alkali (glass). In fructose solns. alone these substances increase the amylase production. The amylase production is the same in KH₂PO₄ and K₂HPO₄ solns. It is not influenced by glycerol, promoted by glucose and starch and inhibited by fructose, mannose, lactose, inulin and the metabolites formed in the presence of mannose or galactose although not by galactose itself. There seems to be a certain relation between the structure of the diastase and that of the sugars which *A. niger* can assimilate.

MARY JACOBSEN

Fermentation of substituted carbohydrates by bacteria of the colon-lactis aerogenes group. HERMAN HEES AND CASPER TROPP. *Centr. Bakt. Parasitenk. I Abt.* **100**, 273-84 (1926).—The fermentation of many methylated sugars, alcs. and glucosides was studied. The eosin-methylene blue medium of Levine is the best means for sepn. of

B. coli and *B. aerogenes*. Two S-contg. carbohydrates, benzylthiogluco-side, and glucose-ethylmercaptan, were fermented by *lactis aerogenes* only. JOHN T. MYERS

Infertilizing power of some vegetable essences against human tubercle bacilli in vitro. P. COURMONT, A. MOREL AND I. BAY. *Compt. rend. soc. biol.* **96**, 1313-4.—Of phenol, guaiacol, thymol, oil of savory, lavender, citron, orange, bergamot and spike, thymol has the strongest infertilizing power. Of the essences that of thymol is most active. Guaiacol, which is sometimes used in the treatment of tuberculosis, is among the least active. L. W. RIGGS

Weakening action of the colloidal state on the infertilizing power of essences with reference to microorganisms. A. MOREL, A. ROCHAIX AND A. CHEVALLIER. *Compt. rend. soc. biol.* **97**, 495-6 (1927).—Tests with thymol, carvacrol and essence of *Eucalyptus citriodora* and of *E. globulus* showed a diminution of the infertilizing power of these essences on passing from the mol. to colloid state. L. W. RIGGS

Study on *B. coli* in water and milk by means of esculin media. A. RICHAIK. *Lait* **4**, 541-4 (1924); *Abstracts Bact.* **9**, 325.—Esculin, a glucoside derived from Indian chestnuts, is broken down by some organisms into glucose and esculetine, a complex diphenol which gives a brown color with ferric citrate. An agar medium contg. peptone, bile salts, esculin and ferric citrate was used with 51 strains of *B. coli*. The characteristic dark halo failed to appear in 37.25% of the cases. Moreover, many other bacteria give the characteristic reaction. Conclusion: Esculin fermentation does not give a reliable reaction for detecting *B. coli* in water or milk. H. G.

The fate of *B. coli* and *B. aerogenes* in sewage purification (HEUKELEKIAN) **14**.

D—BOTANY

B. M. DUGGAR

Investigations of the effect of the potash supply on the chlorophyll content, assimilation, growth and yield of potatoes. TH. REMY AND H. LIESEGANG. *Landw. Jahrb. Schweiz.* **64**, 213-40; *Chem. Zentr.* **1926**, II, 2104-5.—Three problems were investigated: (1) the influence of the K supply on the chlorophyll content of the leaves; (2) the existence of some relation between the chlorophyll content of the leaves and the assimilation process; and (3) the reason why plants with an adequate supply of K_2O but with low chlorophyll content show better assimilation than plants deficient in K_2O . (1) Field expts. with kainite, KCl and K_2SO_4 showed that the chlorophyll content of potato leaves is greatly diminished by K_2O , confirming the observation of Maiwald. (2) The starch test of J. Sachs showed that plants adequately supplied with K_2O always contained more starch than the spotless leaves of plants deficient in K_2O . There is then no relation between chlorophyll content and assimilation. (3) The smaller chlorophyll content in leaves of plants satd. with K_2O is more than compensated by the larger size of the leaves. The leaves of healthy plants have a longer span of life than those of plants deficient in K_2O . An adequate K_2O supply is the basis of a strong assimilation process. Expts. with sugar beets were unsuccessful because the method of detn. of chlorophyll according to Willstätter failed to give results. C. C. DAVIS

The relation of maturity of California plums to shipping and dessert quality. F. W. ALLEN, J. R. MAGNESS AND M. H. HALLER. *Calif. Agr. Expt. Sta., Bull.* **428**, 1-41 (1927).—Changes which were studied as the fruit of different varieties matured on the tree as well as after picking and storage included (1) increase in size, (2) change in color, (3) firmness of flesh, (4) sol. solids and sugar content, and (5) acidity. Increase in size continues at the rate of 1.5-2% daily until the fruit becomes fully colored. Measured by a *mech. pressure tester*, the firmness of the flesh gives an accurate index of the maturity and shipping quality of plums. Sol. solids increase from the time the first color appears to full maturity. The amt. of increase is insufficient for hydrometer readings to serve as an index to picking maturity. Sugar content increases as long as the fruit remains on the tree. Plums contain from 1 to 3% acid when picked, the acidity decreasing with later pickings. In early picked fruit, the expressed juice and the fruit as a whole are approx. equal in acidity. In later pickings there is much less acid in the expressed juice. After picking most varieties soften twice as rapidly at 52° F. as at 43° F. The rate of softening is controlled largely by temp. Sol. solids remain const. after picking though the sugar content increases somewhat in the larger, meaty types, though in other varieties no increase is shown. The acidity of the expressed juice decreases gradually after picking. Prompt pre-cooling and refrigeration are recommended for plums to be marketed at a distance from the orchard. C. R. F.

Cauliflower production in California. H. A. JONES AND F. H. ERNST. *Calif. Agr.*

Expt. Sta., *Circ.* 11, 1-36(1927).—The growth, fertilizer treatment, blanching, harvesting, grading, standardization and shipping of cauliflower are presented.

CARL R. FELLERS

Pollination and life history studies of lettuce (*Lactuca sativa* L.). H. A. JONES. *Hilgardia* 2, 425-79(1927).—An embryological and cytological study.

C. R. F.

Freezing as a method of preserving plant tissue for the determination of nitrogenous fractions. G. T. NIGHTINGALE, W. R. ROBBINS AND L. G. SCHERMERHORN. N. J. Agr. Expt. Sta., *Bull.* 448, 1-16(1927).—Methods are described for the aq. extn. of nitrogenous constituents from green plant material. These fractions include protein, sol. proteose, basic, amide, amino, NH_3 , humin and nitrate N. Beet leaves, tomato and sweet potato stems, and sweet potato storage roots were the materials used. Two freezing tests were used, *i. e.*, 48 hrs. and 7 days at temps. between -5° and -14° . Macro-chem. data are presented which show that minced plant tissue may be preserved by freezing with no modification of nitrogenous fractions which interfere with the methods here employed for N dissection. Amino acids or nitrogenous materials of humin N filtrates do not interfere with the recovery of NO_3 -nitrogen by the Ulsch method. The necessity of supplementary microchem. observations in studies involving N metabolism is emphasized. A list of 28 references is given.

C. R. F.

Determination of hardness in apple varieties and the relation of some factors to cold resistance. AUBREY C. HILDRETH. Minn. Agr. Expt. Sta., *Tech. Bull.* 42(1926).—Neither moisture content, sugars, pentosans nor amino N offered a reliable basis for sepg. hardy and tender varieties. There was some indication that high reserves of carbohydrates and of org. N might be correlated with greater hardness. Degree of cold injury is directly proportional to the duration of exposure to a given low temp. A rapid fall in temp. above the killing point is more injurious than gradual lowering. The importance of desiccation as a factor in winter killing is questioned. Terminal growths of apple varieties of known hardness have been exposed to artificially produced low temps. Classifying these varieties on the basis of the resultant injury, the order agrees closely with that of their hardness as shown by field experience. The rise of this test in detg. hardness of seedlings and varieties of unknown cold resistance seems practical.

CARL R. FELLERS

Anthocyanins appearing in the pigment of Isabella grapes. R. J. ANDERSON AND F. P. NABENHAUER. N. Y. Agr. Expt. Sta., *Tech. Bull.* 123, 1-13(1926).—The pigment in Isabella grapes is a monoglucoside, $\text{C}_{23}\text{H}_{35}\text{O}_{12}\text{Cl} + 4\text{H}_2\text{O}$, prisms. It appears to be identical with the anthocyanin, enin, which appears in the blue European grape. Anthocyanidin chloride, $\text{C}_{17}\text{H}_{15}\text{O}_7\text{Cl} + 1.5\text{H}_2\text{O}$, prepd. by hydrolyzing the glucoside, crystallizes in prisms, and is apparently identical with enidin. When the Ac deriv. of the anthocyanidin was oxidized with neutral KMnO_4 , syringic acid was formed and by sapon. of the latter, acetylsyringic acid was obtained. The compn. of enidin chloride is represented as 3,5,7-trihydroxy-2-(4-hydroxy-3,5-dimethoxyphenyl)benzopyrylium chloride.

CARL R. FELLERS

Microchemical researches. B. HEINZE. *Landw. Jahrb. Schweiz.* 64, 65-169; *Chem. Zentr.* 1926, II, 1569-70.—A discussion of the importance of the nitro bacteria and vitamins for the cultivated plants.

A. L. HENNE

Recent advances in science: agricultural physiology. JOHN HAMMOND. *Science Progress* 22, 218-24(1927).—A review of recent biochem. work on various aspects of growth.

JOSEPH S. HEPBURN

The tannin cells in the fruit pulp of different varieties of Diospyros (date plum, persimmon, etc.). C. GRIEBEL. *Z. Untersuch. Lebensm.* 53, 525-34(1927).—The fruit pulp of *D. lotos* L., *D. virginiana* L. and *D. kaki* L. fil. consists chiefly of mesocarp cells and of cells which contain a compd. which on hydrolysis with KOH yields gallic acid, phloroglucinol and pyrocatechol.

WILLIAM J. HUSA

Some changes occurring during the ripening of grapes. III. P. R. V. D. R. COFFMAN. Dept. Agr. Union S. Africa, *Science Bull.* 60, 19 pp.(1927); cf. *C. A.* 21, 2012.—The results of this work confirmed those obtained in previous investigations. Data on 6 varieties of grapes indicated that definite equil. between acid, sugar and solids was established at maturity.

K. D. JACOB

The value of the chemical test in the identification of wild white clover. WM. M. FINDLAY AND GEORGE DOWER. *Scottish J. Agr.* 10, 219-24(1927).—The test is based on the production of HCN, as indicated by the change in color from yellow to reddish brown of test papers dipped in a soln. of Na_2CO_3 and picric acid, when crushed seedlings of wild white clover are incubated at 32° for several hrs. From a study of this test it was concluded that if the large and small seeds of a sample of English wild white clover both give strong positive reactions it indicates that the sample is true wild

white clover. If the large seeds of a sample give a weaker reaction than the small seeds it indicates that the sample is either cultivated wild white clover contg. a proportion of ordinary white clover, or a mixt. of ordinary and wild white clover. Samples of English seed that gave a strong positive reaction gave good yields when sown in the field while those that gave negative reaction were failures. Many samples of American white clover reacted positively to the test. K. D. JACOB

Seasonal variations in the carbohydrate content of swedes. JOHN CALDWELL. *Scottish J. Agr.* 10, 325-32(1927).—The total carbohydrate content of swedes of the Scotia variety was highest in roots harvested about the first of December, the dry matter and carbohydrate content diminishing rapidly in roots left in the ground after that time. On the other hand, the highest percentages of dry matter and carbohydrates were found in roots harvested during the latter part of September, increases in wt. after that time being largely due to absorption of H_2O . K. D. JACOB

Nitrate utilization by plants. I. The regime of nitrate nitrogen under natural conditions of plant development. A. SHMUK. *Ann. Kuban Agr. Inst.* (Russian) 3, 77-94(1926).—Summarizing the results of a series of expts. S. concludes that soils entirely covered with vegetation contain either no free nitrates, or very minute amounts. Disappearance of nitrates cannot be explained exclusively by the direct utilization of nitrates, by leaching out or by inhibition of nitrification processes. It is a result of the specific action of the root-mass, which stimulates the activities of denitrifying organisms as well as the denitrifying enzymes of the plants. The reduction of nitrates by plant roots in soln. goes on with great energy and the products formed are nitrites and ammonia; it is thus logical to look to ammonia as a N source for plants. J. S. JOFFE

The cashew nut. H. LUDOWYK. *Trop. Agr. (Ceylon)* 69, 43-6(1927).—A short review of the chemistry of the nuts of *Anacardium occidentale* is given. A. L. M.

Distribution of potassium and sodium in terrestrial plants. G. ANDRÉ and E. DEMOUSSY. *Bull. soc. chim. biol.* 9, 861-6(1927). See C. A. 20, 3069. L. W. R.

Production of nitrites by *Verticillium* in pure culture. J. DUFRÉNOY. *Bull. soc. chim. biol.* 9, 934-5(1927).—Cultures of the fungus *Verticillium*, isolated from various common trees and plants, showed the presence of nitrites after 15 days at 25°.

L. W. RIGGS

Nature of the sugars and of their metabolism in the iris. H. COLIN and A. AUGEM. *Compt. rend.* 185, 475 8(1927).—*Iris germanica*, the closely allied species *I. pallida* and *I. florentina* and innumerable derived varieties have a rhizome contg. starch. *Iris pseudacorus* on the contrary stores in reserve a levulosan, irisin, without a trace of starch; its seeds have a horny albumin rich in mannoses and 0.1% of starch. *Iris foetidissima* is intermediate between *I. pseudacorus* and *I. pallida* in that its rhizome and seeds contain both levulosan and starch. The leaves of the 3 species contain starch only in the stomata. It is remarkable that a thousand attempts to cross these species have failed. L. W. RIGGS

Determination of the osmotic value of the yeast cell by changing the weight of the cell. G. SELIBER and (MLLE.) R. KATZNELSON. *Compt. rend. soc. biol.* 97, 347-9(1927); cf. following abstr.—Yeast cells immersed in solns. of NaCl of different concns. gain or lose water according to the concn. of the soln. When the cell has lost a certain quantity of water it becomes plasmolyzed, and the concn. under which plasmolysis occurs is called the *osmotic value*. The no. of billions of cells per g. in 2% soln. of NaCl was 7.41 by filtration and 6.43 by centrifugation; in 4% soln. of NaCl the figures were 11.2 and 9.65, resp. It is probable that by prolonged centrifugation the figures would more nearly approach those obtained by filtration. L. W. RIGGS

Influence of the composition of the medium on the osmotic value of the yeast cell. G. SELIBER and (MLLE.) R. KATZNELSON. *Compt. rend. soc. biol.* 97, 449-50(1927); cf. preceding abstr.—The addn. of NaCl to the medium causes an increase in the osmotic value of the cell. The addn. of sucrose or glucose to the medium causes an increase in the osmotic value proportional to the amt. of sugar added. The increase for glucose is less in proportion to its mol. concn. than for sucrose. L. W. RIGGS

Influence of mercuric chloride on the osmotic value of the yeast cell. G. SELIBER and (MLLE.) KATZNELSON. *Compt. rend. soc. biol.* 97, 515-6(1927); cf. preceding abstr.—Yeasts acclimated to $HgCl_2$ show an increase in the concn. of cell juice and of dry matter. L. W. RIGGS

Selection for quality of oil in soy beans. L. J. COLK, E. W. LINDSTROM and C. M. WOODWORTH. *J. Agr. Research* 35, 75-95(1927).—Continuous selection both for high and low quality of oil within one variety of soy bean for 7 years produced a high and a low line differing to a significant extent in their av. I number. An av. of the last

3 years' data showed an I value of 133.7 for the high line and 124.9 for the low line. The high line selected entirely on the basis of chem. analyses proved to be a late tall type with purple flowers whereas the low line was early dwarf and white-flowered. The evidence indicates that late maturity provides the more favorable conditions for the complete development of the unsatd. acids that are responsible for high quality of oil. Selection for high or low quality of oil proved to have no appreciable effect on the quantity or percentage of oil produced by the plant which makes it possible to select for high quality without decreasing the percentage of oil. W. H. R.

Metabolism of nitrogen compounds in dormant and non-dormant potato tubers. WILLIAM NEWTON. *J. Agr. Research* 35, 141-6(1927).—The absorption of nitrates by potato tuber tissue abbreviated the dormant period but under the same conditions NH_4 salts did not affect it. There was a tendency for the amino and amide N to be greater in non-dormant than in dormant tubers but growth was not directly dependent upon the actual concn. of either of these compds. Proteolytic enzyme activity was more intense in the expressed juice of non-dormant than in that of dormant tubers. When casein was added to the juice the rate of the accumulation of amino acid was a straight-line function of the time of incubation. Evidence was obtained which indicated that when potato juice is incubated amino acid N is converted into amide N. The addition of asparagine to dormant tuber juice activated the carbohydrate hydrolytic enzymes but had no apparent influence upon non-dormant tuber juice. W. H. ROSS

Plant physiology at the Ithaca Congress. FRANK THONE. *Plant Physiology* 1, 293-305(1926).—A synopsis of the papers related to the physiology of plants given before the International Congress of Plant Sciences at Ithaca, N. Y., August 16-23 (1926). WALTER THOMAS

Temperature effects in the metabolism of wheat. W. E. TOTTINGHAM (WITH THE ASSISTANCE OF E. J. RANKIN, A. D. DICKSON AND H. W. LOUWSME). *Plant Physiology* 1, 307-36(1926).—Details (with figure) are given of improvements in app. (cf. C. A. 17, 3523) for the control of environmental factors in plant growth, together with methods of estg. the total illumination effective from the sun and artificial sources. Each one of 9 series of wheat cultures in water, sand and soil were subjected to 2 planes of temp., but to uniform illumination and atm. humidity. Atm. humidity has little influence upon the protein content of wheat during the period of seed development. Considering only fully nourished plants, under the lower plane of illumination (530 and 1150 foot candles over a 12-hr. day), the production of dry matter (especially straw) was favored by the lower temps. and the percentage of protein was increased, but at the expense of the available carbohydrates. With adequate illumination (1560 and 2510 foot candles over a 12-hr. day), plants harvested at $\frac{1}{3}$ and $\frac{1}{4}$ their full growth periods contained greater percentages of sucrose and protein at lower temps. This storage is probably detd. by the plane of sugars, the latter then detg. the plane of protein synthesis. Mature plants contained increased percentages of carbohydrates and gave much greater yields, especially of grain, at the lower temps. As an explanation of these results, Tottingham advances the idea of a crit. balance between the temp. responses of photosynthesis and respiratory decompn. WALTER THOMAS

Studies on the oxidation of certain fatty acids. J. B. RHINE. *Plant Physiology* 1, 349-61(1926).—Hydrolysis of the mixed fatty acids from linseed oil by enzymes from germinating fatty seeds gave negative results. Hydrolysis at higher temps. (60-95°), increased acidity, and with an abundant supply of O, indicated that fatty acids undergo a mild oxidation, in which they absorb O, become hydroxylated and break up into shorter-chain acids and aldehydes and probably into other fragments. This breakdown differs in its products from all other methods of oxidizing fatty acids. The products remaining in soln. in water approach more nearly the sugars in structure than those reported in any previous method of oxidation. The products consist of (1) unidentified water-sol., ether-insol. non-volatile aldehydes, having more O than that of the aldehyde or carbonyl group; (2) unidentified volatile aldehydes, sol. in water and in ether; (3) short-chain volatile acids sol. in water, ether and alc., fermentable by bread yeast, giving CO_2 . WALTER THOMAS

The chemical analysis of plant tissues. C. O. APPLEMAN, W. E. LOOMIS, T. G. PHILLIPS, W. E. TOTTINGHAM AND J. J. WILLAMAN. *Plant Physiology* 1, 397-402 (1926).—Recommendations of the Comm. on Methods of Analysis of Plant Material for the American Society of Plant Physiologists. The first report consists of a crit. discussion with suggestions of methods of (1) sampling, (2) extn., (3) desiccation, (4) removal of lipoids, (5) detn. of moisture and (6) expressing results. W. T.

The use of potassium oxalate as a deleading reagent. W. E. LOOMIS. *Plant*

Physiology 1, 403-7(1926).—The advantages and disadvantages of the various leading reagents recommended for clarifying exts., preparatory to the detn. of sugars, are discussed (cf. *C. A.* 10, 2993; 17, 2091). L. modifies his previous recommendation (cf. *C. A.* 21, 3652) by giving 0.2-0.5g. as the proper excess of $K_2C_2O_4$ to be added.

WALTER THOMAS

Aqueous extracts of seeds as agents in the preparation of silver sols. R. V. MILLER AND R. P. HIBBARD. *Plant Physiology* 1, 409-13(1926).—Stable negatively charged Ag sols, having elaborate colors, were prepd. by the addn. of 2 drops of 0.1 *N* $AgNO_3$ to the filtered aq. exts. of pea, bean, tomato, corn, wheat, buckwheat, grass, sunflower, lettuce, beet, rice, soy bean and cotton seeds. The speed of the reaction is increased by exposure to sunlight, but over-exposure will ppt. the Ag. The reducing substances have not been identified, but results thus far lead to the belief that they consist of alc. and water-sol. proteins, with sugar as the stabilizer. The active materials appear to be most abundant in the seed coats.

WALTER THOMAS

Climatic effects in the metabolism of maize. W. E. TOTTINGHAM AND H. W. KERR. *Plant Physiology* 1, 415-6(1926); cf. *C. A.* 20, 2872.—The analyses were made on the composite samples of leaf, stalk and ear tissue taken from 50 plants 6 times in a period of 10 days during mid-August. The percentage of sucrose in the dry matter of the leaf greatly exceeded that of reducing sugars. Both sucrose and dextrins varied in general with solar radiation. Sugars in the stalk and ear varied independently of their proportions in the leaf, and the same was true of mono-amino acids. The compn. of the stalk was relatively stable and correlated with that of the ear. Comparison of the compn. in leaves of Yellow Dent maize with that of Marquis wheat and Black Amber sorghum grown in adjacent fields with similar cultural treatment and sampled simultaneously suggests that the stability of maize and sorghum against climatic influences may be due to their higher content of sucrose and less sol. forms of protein, and lower content of such reactive compds. as glucose, sol. proteins and other sol. nitrogenous compds. More data, however, are needed to det. this definitely.

WALTER THOMAS

A device for maintaining constant level of culture solutions. F. G. ANDERSEN. *Plant Physiology* 1, 417-8(1926).—Description with figure of the app. successfully used at the Univ. of Calif. for growing woody plants in continuously flowing culture soln.

WALTER THOMAS

Substances accompanying cellulose. KURT HESS. I. **Plant cell membranes. The carbohydrates of the ivory nut.** MAX LUDTKE. *Ann.* 456, 201-24(1927).—The dry ivory nut meal, after extn. with 0.25-0.3% ClO_2 soln., contains 7.8% cellulose. After extn. of mannan A (I) with 5% and then with 10% NaOH, mannan B (II) is sepd. as the Cu alkali compd., which is decompd. with 5% AcOH and pptd. with MeOH; the yield is about 18 g. per 100 g. extd. meal; II is a white, somewhat hygroscopic powder, which gives a violet color with $ZnCl_2$ but is not colored by $KI.I.H_2SO_4$; α^{18}_D 0.513°. II yields a *tri-Ac deriv.*, α^{17}_D -25.2° ($CHCl_3$); hydrolysis gives mannose. Pure I gives no reaction with $ZnCl_2$ or $KI.I.H_2SO_4$, α^{20}_D -44.94° (*N* NaOH); the *tri-Ac deriv.* has α^{21}_D -29.41° (*N* NaOH). Hydrolysis gives mannose. The behavior of I and II in NH_4OH -Cu(OH)₂ solns. is discussed. The max. yield of reducing substance (90-3%) is obtained by 12 hrs. hydrolysis with 75% H_2SO_4 . No trace of glucose was found.

C. J. WEST

Relation between respiration and water content in higher fungi, with a note on the effect of light on respiration. F. J. RICHARDS. *New Phytologist* 26, 187-201(1927).—With a given species of fungus the rate of respiration of the Sporophore bears a definite relation to the H_2O content. Agarics generally respire faster than Polypores. Desiccated xerophilous fungi when moistened again recover respiration only so long as spore discharge recovers also. No evidence was found that the rate of respiration of fungus Sporophores differs in any constant manner in darkness from the rate under diffuse daylight or elec. lamps.

H. R. KRAYBILL

The utilization of atmospheric nitrogen by green plants. GEORGES TRUFFAUT AND N. BEZSSONOFF. *Rev. gen. sci.* 37, 389-94(1927).—Corn plants were grown in cultures inoculated with various N-fixing bacteria and in sterile cultures. Very marked increase in growth was obtained in the cultures with N-fixing bacteria. The results show that many plants can obtain their necessary N at the expense of the air from that fixed by bacteria nourished on the excretions of the plant.

H. R. KRAYBILL

The influence of soil reaction on the growth of plants. EBERHART HOLZAPFEL. *Landw. Jahrb.* 65, 745-77(1927).—The effect of increasing p_H is shown in plant growth, food value and absorption of Ca and H_3PO_4 . The alky. of the plant ash increases with

p_H with the exception of clover. The ratio mol. $\text{CaO/mol. P}_2\text{O}_5$ according to Wrangell is found not to be a true measure of the absorption of H_3PO_4 by the plant. Neutralization of the acidity by $\text{Mg}(\text{OH})_2$ has the same effect as $\text{Ca}(\text{OH})_2$, if there is sufficient Ca for food.

GEORGE R. GREENBANK

Influence of radium rays upon hereditary variations in the *Datura stramonium*. C. S. GAGER WITH A. F. BLAKESLEE. *Ann. Rept. Brooklyn Botanic Garden* 16, No. 2, 25; No. 3, 165 (1927).—Preliminary study of the influence of Ra treatment upon the hereditary units in flowers of *Datura stramonium* indicated (1) a higher % of chromosomal mutations; (2) a new compd. chromosomal type; and (3) new factor mutations. These expts. are being continued.

N. M. NAYLOR

Influence of the absolute reaction of the soil on the formation and the composition of the essential oil of Marjolaine (DEEL, DEEL) 17. Stomatal numbers, their value for distinguishing species (TIMMERMAN) 17. Preharvest factors which affect wheat quality (MENGELS) 12. Genetic relation of terpenes (ASCHAN) 10.

E—NUTRITION

PHILIP B. HAWK

A color reaction associated with vitamin D. M. J. SHEAR. *Proc. Soc. Exptl. Biol. Med.* 23, 546-9 (1926).—Three cc. of a soln. of 1 part concd. HCl and 5 parts aniline were added to an equal vol. of oil in a wide test tube. The contents were mixed and boiled for $\frac{1}{2}$ min. Upon standing the mixt. sepd. into 2 layers, the lower layer was colored an intense red when oils supposedly contg. vitamin D were used. C. V. B.

Studies on inorganic salt metabolism. II. The effect of the sudden alteration of the acid-base balance of the diet on dogs. M. R. JONES. *Proc. Soc. Exptl. Biol. Med.* 23, 578-81 (1926); cf. *C. A.* 21, 1467.—Convulsions and in some cases death followed the sudden alteration of the acid-base balance of the diet in dogs. The nature of the phenomena is not explained.

C. V. B.

The production of antirachitic properties in human milk resulting from irradiation of the mother. A. F. HESS, M. WEINSTOCK AND E. SHERMAN. *Proc. Soc. Exptl. Biol. Med.* 23, 636-8 (1926).—The exposure of a woman to the rays of a Hg vapor quartz lamp every other day for the period of 1 month produced antirachitic properties in her milk. Rachitic rats, given 25 cc. of this milk daily, rapidly recovered as shown by the radiograph and by the increase of inorg. P in the blood from 1.98 mg. % to 5.61 mg. %. The milk had no curative properties during the control period.

C. V. B.

Changes in the excretion of uric acid produced by experimental hepatic insufficiency. J. L. BOLLMAN AND F. C. MANN. *Proc. Soc. Exptl. Biol. Med.* 23, 685-7 (1926).—After an 18-hr. fast, the ingestion of 175 g. of fresh pancreas is followed by the excretion of 120 mg. of uric acid in 24 hrs. in the normal dog. Dogs with an Eck fistula excrete from 120 to 750 mg. in the 24 hrs. after feeding; the amt. is roughly proportionate to the extent of liver atrophy.

C. V. B.

Epinephrine reaction in obesity. C. I. KRANTZ AND J. H. MEANS. *Proc. Soc. Exptl. Biol. Med.* 23, 698-9 (1926); cf. *C. A.* 21, 3393.—The rise in metabolism and in ventilation after epinephrine injection in obese subjects showed no significant difference from that in normal controls. The basal respiratory quotient was lower in the obese and along with the pulse pressure showed less increase following epinephrine.

C. V. B.

Avitaminosis and inoculation "in vivo." C. SETTI. *Biochim. terap. sper.* 14, 137-45 (1927).—Pigeons in avitaminosis show less resistance to virulent bacteria inoculation.

A. W. CONTIERI

The action determined by the type of feed in normal feed and in autoclaved feed. G. GUERRINI. *Biochim. terap. sper.* 14, 153-70 (1927).—Doves which show a preference for a certain one of the foods, rice, peas and lentile, prefer the same feed even when autoclaved. In all cases, however, the autoclaved feed is less sufficient than the normal.

A. W. CONTIERI

Defects in nutrition and their importance with respect to the blood sugar and glycogen of the organs. II. Studies of carbohydrate exchange. GEORG EISNER. *Z. ges. exptl. Med.* 52, 214-47; *Chem. Zentr.* 1926, II, 2611; cf. *C. A.* 21, 947.—Normally nourished rabbits tolerated the feeding of excess dextrose for long periods without injury. During hunger, the blood sugar curve increased with increasing loss of wt. and its inax. was postponed. Large quantities of glycogen appeared in the liver, but this content returned to normal after 24 hrs. Feeding of excess grape sugar also resulted in loss of wt., glucosuria and disappearance of glycogen. Disappearance of glycogen occurred in all animals fed merely excess sugar. The absence of glycogen in the liver

probably lasts only a few hrs. after feeding of dextrose. During hunger the capacity for forming and fixing glycogen was retained, whereas animals fed only sugar, and therefore deficient in vitamins, lost their capacity for fixing glycogen. C. C. DAVIS

Vitamin R. F. HERRING. *Z. med. Chem.* 4, 56-7; *Chem. Zentr.* 1926, II, 1906.—**Vitamin R** (where R is the first letter of the producer's name) is an ext. from a specially grown type of yeast. From the indigestible yeast cells are extd. chem. health factors (nucleoproteins, tryptophan, lipoid-P, 2% lecithin and enzymes) and converted to a form which renders them directly assimilable by the organisms. It is recommended that they be added to denatured milk. C. C. DAVIS

Pharmacognostic themes. III. Secretions and excretions. L. E. GOESTER. *Pharm. Weekblad* 64, 1001-16(1927).—A discussion of the origin and function of volatile oils, balsams, resins and gums in the plant economy. A. W. DOX

The white potato as a source of vitamin B. J. F. LYMAN AND INEZ BLYSTONE. *J. Home Econ.* 18, 199-204(1926).—The white potato used as the sole source of vitamin B in the diet supplies enough for practically max. growth in white rats when it constitutes 80% of the ration. When it constitutes 40% or less there is rapid nutrition failure which is relieved by the addn. of yeast mixts. With only 5% potato present typical polyneuritis appears almost as soon as when vitamin B is absent from the ration. L. D. ELLIOTT

Maternal diet and lactation. P. MABEL NELSON. *J. Home Econ.* 18, 383(1926).—Expts. on lactating rat mothers and their litters afford evidence that the toxic symptoms observed in litters whose mothers are consuming certain high protein diets are due not to the protein per se but to accompanying deficiency in vitamin B. L. D. E.

Vitamin E and iron assimilation. NINA SIMMONDS. *J. Home Econ.* 19, 585-7(1927).—In a series of expts. designed to discover the limiting factor in milk when this is the sole source of nutrients milk powder and carbohydrates supplemented with small amts. of a number of normal foods were fed. When 95% of the milk-carbohydrate-agar mixt. was supplemented with 5% of a cereal grain, wheat germ, yeast, purified proteins of various kinds, cooked beefsteak, or cooked beef liver, only the liver proved highly effective in making good the deficiencies of milk, as little as 2% of cooked dried beef liver being very effective. Liver being rich in both vitamin E and in iron it is suggested that its value in anemia may be due to this fact. L. D. ELLIOTT

Utilization of rye from the nutritive standpoint. ERICH GEORGE. *Ber. Verhandl. sächs. Akad. Wiss. Leipzig, Math.-phys. Klasse* 78, 381-98(1926).—Two normal students were placed on a carefully regulated rye bread, sugar and fat diet, for periods of 6 days each. Increasing strengths of rye flour were used each period. Comparative analysis of the bread ingested and the resulting feces and urine showed a progressive percentage loss in N, calorific value, ash, org. solid matter, etc. Both persons lost weight with a fusion of body tissues as indicated by a negative N balance. R. C. E.

Does the net energy value of food depend upon the purpose for which it is used in the body? H. H. MITCHELL. *Science* 66, 289-92(1927).—Exptl. evidence indicates that no net energy value can be assigned for a given food function. Animal detn. of relative net energy food values are being obtained on assumptions and in contradiction to established exptl. findings. RUSSELL C. EBB

The influence of a change in diet on the peripheral blood vessels. I. Meat diet and vegetable diet. M. GANSSLEN. *Klin. Wochschr.* 6, 786-91(1927).—An exclusive meat diet leads to an enlargement of the peripheral capillaries with kinks and aneurysal sacks. The results are similar to those obtained after administration of histamine. An exclusive vegetable diet leads to an elongation and a reduction of the diameter of the capillaries. MILTON HANKE

Ergosterol balance. H. BEUMER. *Klin. Wochschr.* 6, 941-2(1927).—Ergosterol (provitamin A) was fed to a premature baby in 0.1-g. portions on four successive days. The stools were analyzed for ergosterol. Only 147 mg. was recovered. The excretion had stopped three days after the last administration. The compd. was either destroyed by bacterial action in the intestine, catabolized in the body or stored. Expts. were not performed to ascertain how the sterol was lost. MILTON HANKE

Rickets prophylaxis. VALERIE BRUCK-BIESOK, C. PIRQUET AND RICHARD WAGNER. *Klin. Wochschr.* 6, 952(1927).—The authors recommend producing an antirachitic milk by irradiating the cow rather than by irradiating the milk. MILTON HANKE

Is the antirachitic vitamin of cod-liver oil an irradiated ergosterol? A. ADAM. *Klin. Wochschr.* 6, 1289(1927).—The author cites evidence that indicates that the above question can be answered in the affirmative. The ultra-violet absorption spectrum of insulin is very similar to that of ergosterol. MILTON HANKE

Antisterility vitamin, fat-soluble E. H. MCL. EVANS, G. O. BURR AND T. L. ALTHAUSEN. *Memoir Univ. California* 8, 1-176(1927).—Chapters are devoted to general characteristics of the sterility disease produced in rats by pure foods or other dietaries lacking fat-sol. vitamin E; the histopathology of gestation in animals deprived of this vitamin; male sterility with dietaries lacking it; the widespread occurrence of initial fertility in animals reared on simplified diets; distribution of the vitamin in foods of animal origin, and of plant origin; proof of the existence of this vitamin in the tissues of animals reared upon natural foods and of its depletion in the tissues of animals reared upon synthetic rations; the survival of fertility in animals shifted from a diet contg. vitamin E, to one deprived of it; the presence of this vitamin in the tissues of normal new born young; proof of the use of this vitamin in the ordinary metabolic processes of the body; the failure of an excess of vitamin E (2 to 20 times the normal requirement) to increase fertility beyond normal limits; the successful parenteral administration of vitamin E as a cure of sterility in female rats; the efficacy of a single curative dose of this vitamin administered at the beginning of gestation; detn. of the min. effective dose of this vitamin in the cure of sterility in the female rat (daily doses of 15 to 30 mg. of wheat germ oil or a single dose of 300 to 600 mg. given intraperitoneally lie on the border of effectiveness for any particular gestation); the latest period in gestation (the 5th day after conception) in which the administration of curative foods ensures the birth of living young; the soly. of the vitamin; its stability toward ultra-violet light, enzymes of wheat germ oil, atm. O₂, sapon. with alkalis, strong acids, hydrogenation, drying, cooking, and extn. from lettuce and animal tissues, and its instability toward Br, Ac₂O, and ashing temp.; steps in its isolation and concn.; and a bibliography. JOSEPH S. HEPBURN

Some digestibility trials on Indian feeding stuffs. II. P. E. LANDER AND PANDIT LAL CHAND DHARMANI. *Memoirs Dept. Agr. India, Chem. Series* 9, 63-83(1927); cf. *C. A.* 19, 1017.—Feeding expts. on bullocks were carried out with wheat bhusa (*Cicer arietinum*), green sarson (*Brassica campestris*) and siloed shisham leaves (*Dalbergia sissoo*). Wheat bhusa alone was not a maintenance ration, the digestibility coeffs. of the protein and ash and the N balance being negative. Shisham silage was also deficient as a maintenance ration. Data are given on the compn. of the whole feeds and of the ash. K. D. JACOB

Blood gases and their relation to the internal secretions of animals kept on a vitamin A and B deficient diet. E. MIYAKE. *Folia endocrinol. japon.* 2, 23-4, 593-641 (1926); *Ber. ges. Physiol. expl. Pharmacol.* 41, 56.—In pigeons and chickens fed on polished rice the plasma CO₂ is increased, in chickens after an initial decrease. In man and dog vitamin B deficiency causes a decrease in CO₂ content and capacity. In both cases oryzanin restores the normal values. The changes resemble those observed in rabbits after the removal of the thyroid or gonads. MARY JACOBSEN

The non-protein nitrogen in certain dairy rations and the partition of nitrogen in the urine produced thereon. W. E. KRAUSS. *J. Dairy Sci.* 10, 400-15(1927).—Data are presented showing the distribution of non-protein N in dairy rations based upon clover and timothy hay, the digestibility of the non-protein N, and its utilization by cows in milk. Included are the results of a study of the partition of the N in the urine collected, while these rations were being fed. The non-protein N in hay and silage varies greatly in different samples, presumably due to the differences in stage of maturity, method of curing, and other factors, and suggests that figures for true protein based on av. analyses are of limited usefulness. The albuminoid N method of the A. O. A. C. is of doubtful accuracy for distinguishing between crude and true protein in feeding stuffs. Dairy rations made up of hay, silage, and grain contain a relatively large amt. of non-protein N, being apparently useful in meeting a part of the protein requirement of a cow in milk. There is no difference in the protein metabolism when timothy hay or clover hay is fed, as indicated by urine analysis. J. C. JURRJENS

The experimental production of stone in the bladder. II. R. MCCARRISON. *Indian J. Med. Research* 15, 197-205(1927); cf. *C. A.* 21, 2500, 2932.—A diet of whole wheat flour, linseed meal, corn flour, salt and calcium phosphate is very potent in causing stone in the bladder and its sequelae. The main faults of the diet are its high content of cereal food and phosphates and its deficiency in vitamin A. F. K.

The experimental production of a new type of goiter unrelated in its origin to iodine. R. MCCARRISON. *Indian J. Med. Research* 15, 247-63(1927).—The basal factor in its causation is a diet contg. more than 60% of white flour or vitamin-poor carbohydrate, 20% or less of protein, with fats and inorganic salts (including iodine) in adequate amounts but no green vegetables or fruits. FRANCES KRASNOW

The mineral metabolism of dairy cattle and swine. E. B. FORBES. *J. Am. Vet. Med. Assoc.* 70, 721-34(1927).—Feeding of bone meal to swine is a means of in-

creasing the strength of the bones and an insurance against rickets and related disorders.

FRANCES KRASNOW

Evidence that nutritional deficiencies are factors in the problems of abortion and sterility in dairy cattle. E. B. MEIGS. *J. Am. Vet. Med. Assoc.* 70, 855-66(1927).—Discussion.

FRANCES KRASNOW

Nitrogen excretion during the addition of carbohydrate to a protein diet. H. FIRGAU, K. HARTMANN AND E. VOIT. *Z. Biol.* 85, 557-66(1927).—The N excretion is changed only slightly, if at all.

FRANCES KRASNOW

Diet and reproduction. II. G. GRIJNS AND K. DE HAAN. *Proc. Acad. Sci. Amsterdam* 29, 873-7(1927).—cf. *C. A.* 20, 3488.

W. D. L.

The fundamental food requirements for the growth of the rat. I. Growth on a simple diet of purified nutrients. I. S. PALMER AND CORNELIA KENNEDY. *J. Biol. Chem.* 74, 591-611(1927).—It has been shown by expts. repeated at intervals covering nearly 5 yrs. that young rats fail to grow normally if at all when fed a basal diet of specially purified casein, dextrin, wheat embryo ext., butter fat, mineral salts, and agar, in proportions presumably adequate for satisfying the growth requirements for protein, energy, mineral elements, and vitamins A and B, and housed so as to repress the natural coprophagistic habits of the species. Conclusion: The requirements for normal growth of the rat involve other nutrients than those usually recognized and incorporated in our basal diet. Further studies suggest a need for vitamin-like factors other than those at present generally recognized. The purification of the protein is an important factor and the basic deficiency or deficiencies can be brought about and augmented by the biol. changes in the digestive tract caused by the suppression of coprophagy. The casein after pptn. from NH_4OH soln. was heated to 80-90° for 2-3 hrs., leached with slightly acidified H_2O for 5-7 days or percolated with distd. H_2O for 4-6 days, extd. with cold 85-90% alc. for about 4 days and with almost boiling alc. for 3 days, then with Et_2O for 2 or 3 days, dried in a steam-heated drying drawer in a current of air and pulverized.

A. P. LOTHROP

Determination of vitamin A content in liver oil of the dog-fish *Squalus sucklii*. H. N. BROCKLESBY. *Can. Chem. Met.* 11, 238(1927).—Two sets of expts., in which a comparison is made of the vitamin A potency of cod-liver oil and dog-fish liver oil in curing xerophthalmia in white rats, indicate that liver oil from the dog-fish *Squalus sucklii* is a potent source of vitamin A.

N. M. NAVLOR

Dietary requirements for reproduction. XII. The inefficiency of the lactating mother to secrete vitamin B in the milk and the relation of such phenomenon to infant mortality. BARNETT SURE. *Science* 66, 265-6(1927); cf. *C. A.* 21, 2921.—A quantitative biological method for the study of vitamin B requirements for lactation is described. Mothers with litters of 6 are given vitamin-B-free diet until the young reach the maintenance curve, then yeast concentrate as a curative added to the diet. Expts. include addn. of yeast to the diet of the mother and to the diet of the young. Results indicate an optimum requirement of vitamin B for the mother and for the young during different stages of lactation, the amt. depending on the condition of the mother and the age of the young. Infant mortality may have a cause in the inability of the nursing mother to secrete vitamin B quickly and in sufficient quantity into the milk.

N. M. N.

Carbon dioxide nutrition of plants. HUGO FISCHER. *Ber. deut. botan. Ges.* 45, 331-9(1927).—Exptl. data are presented to show that the CO_2 content of the atm. is frequently a limiting factor in plant growth. The economic aspects of CO_2 fertilization are discussed.

W. NEWTON

The usefulness of serodiagnosis in plant relationship studies. E. GILG AND P. N. SCHÜRHOFF. *Ber. deut. botan. Ges.* 45, 315-30(1927).—A critical review of expts. designed to prove that plant relationships may be based upon the existence of similar proteins in the seed as established by serodiagnosis.

W. NEWTON

New aspects of the problem of vitamins. BICE NEPPI. *Giorn. chim. ind. applicata* 8, 432-7(1926).—The topics considered are: nature of vitamins, their origin, their classification, liposoluble vitamins, vitamin B, vitamin C, estn. of vitamins. A bibliography is appended.

ROBERT S. POSMONTIER

Net-energy values of corn silage, soy-bean hay, alfalfa hay and oats. E. B. FORBES, WINFRED W. BRAMAN, MAX KRISS, J. AUGUST FRIES, C. D. JEFFRIES, R. W. SWIFT, ROWLAND B. FRENCH AND J. V. MAUCHER, JR. *J. Agr. Research* 34, 785-96(1927).—The net-energy values per kg. of dry matter of corn silage, soy-bean hay, alfalfa hay and ground oats for the maintenance of 2-3-year-old beef steers vary from 1.272 cal. for alfalfa hay to 2.476 cal. for ground oats. The net energy of a feed is much more significant and consistent than is metabolizable energy as a measure of the energy value of a feed in nutrition. The maintenance requirements of net energy of the 3 steers

used as subjects were 1.470, 1.517 and 1.537 cal., resp., per sq. m. of body surface, and 1.818, 1.896 and 1.896 cal., resp., per 100 kg. of live wt. W. H. ROSS

A comparison of the direct measurement of the heat production of cattle with the computation of the heat production by the respiratory-quotient method. R. B. FORBES, MAX KRISS, WINFRED W. BRAMAN AND R. B. FRENCH. *J. Agr. Research* 34, 865-78(1927).—The computation of the heat production of cattle by the respiratory-quotient method, as modified by either Andersen or Krogh (*C. A.* 15, 1556), gives results which agree very well with direct heat measurements. Andersen's and Krogh's methods of computation while somewhat different in theory and while yielding respiratory quotients differing in magnitude and in significance, yield virtually identical values for heat production of cattle. Thus 18 detns. of the computed heat production according to Andersen, divided by the directly observed heat production, differed from a similar value involving Krogh's method by only 0.1 to 0.4% with an av. of 0.24%. W. H. R.

The basal metabolism of mature chickens and the net-energy value of corn. H. H. MITCHELL AND W. T. HAINES. *J. Agr. Research* 34, 927-43(1927).—Expts. upon 10 mature chickens showed that 83% of the gross energy of ground corn is metabolizable by chickens and that the av. heating effect of corn on cocks and non-laying hens is 51 cal. per 100 g. The corn used in the expts. contained 402 cal. per 100 g. and had a dry matter content of 91%. Its metabolizable energy for mature chickens is therefore 3670 cal. per kg. of dry matter and its net energy value, 3110 cal. W. H. ROSS

Utilization of the grain in kafir and cane silage by dairy cows. R. B. BECKER AND WILLIS D. GALLUP. *J. Agr. Research* 35, 279-82(1927).—When dairy cows were fed cane and kafir silage made from fairly mature whole plants, about $\frac{1}{3}$ of the cane seed and over $\frac{2}{3}$ of the kafir grain were voided in the manure. Chem. analyses showed little utilization of nutrients from these whole kernels during passage through the cow's digestive tract. Some ether ext. was digested but only a small percentage of the crude protein was utilized and the effect upon the crude fiber was variable. W. H. ROSS

The relation between the vitamin B contents of the feed eaten and of the milk produced. S. I. BECHDEL AND HANNAH E. HONEYWELL. *J. Agr. Research* 35, 283-8(1927).—A study was made of the vitamin B potency of milk from 3 cows that were fed for over 2 years throughout their growth period on an exptl. ration that was decidedly deficient in vitamin B growth factor. The milk was fed to rats as a supplement to a vitamin-B-free basal ration on levels of 8, 10, 12, 16 and 20 cc. per rat per day. The vitamin B potency of the milk was found equal to that of herd milk from cows receiving a good winter ration. It is concluded that vitamin B in milk is not dependent upon the presence of this vitamin in the ration of the cow and that cattle differ from non-ruminant animals in their ability to grow to maturity, to produce normal offspring and to maintain vitamin B in their milk when forced to subsist on rations deficient in vitamin B. W. H. ROSS

Absorption spectrum of ergosterol in relation to the photosynthetic formation of vitamin D. R. A. MORTON, I. M. HEILBRON AND E. D. KAMM. *J. Chem. Soc.* 1927, 2000-5.—A study of the absorption spectrum of ergosterol (pro-vitamin D) in alc. soln. as a function of the time it has been irradiated with the light of a quartz Hg arc. In a fresh soln., there are bands at 293.5, 289.5 and 270 μ . After irradiation for 90 min. to 150 min. these bands have practically disappeared and a band at 247 μ has become strong. Six hrs.' exposure causes the disappearance of this band. • Antirachitic activity is assocd. with the band at 247 μ , as proved by animal tests. These results suggest that in the large-scale production of vitamin D, the destructive wave lengths near 247 μ should be screened off. A. E. RUARK

The detection and estimation of vitamin A and of vitamin D in cod-liver oil and various food products. FRANK WOKES AND S. G. WILLIMOTT. *Pharm. J.* 118, 752-7, 792-3; *Chemist & Druggist* 107, 30-1(1927); cf. *C. A.* 21, 1293.—Zucker's method (*C. A.* 17, 3360) of detecting vitamin D (by its administration producing acid feces in rats) was found suitable for quant. application in assay methods, also in examg. dried milks and infants' foods contg. them. Attempts to apply the method clinically to children, however, have not proved successful on account of the difficulty of controlling the diet in this case. An advantage of the method applied to rats is that the progress of the cure can be followed from day to day, and the efficacy of the dose ascertained without the animal being killed. Detns. of p_H of different parts of the gastro intestinal tract in rats on various diets, with and without vitamin D, have shown that the significant areas for the action of the vitamin in curing rickets appear to be the cecum and large intestine, thus explaining the specificity of the fecal reaction, and confirming the work of Bergeim on Ca absorption (cf. *C. A.* 20, 3718). The study of color tests for vitamin A showed that true vitamin blue gives characteristic absorption bands at 590

and 617μ ; then the color fades with parallel formation of red or yellow. This differentiates vitamin blue from blue colors given by carotin, xanthophyll and other plant pigments. Removal of the interfering pigments by adsorption with charcoal (Norit) enabled color tests to be successfully applied to a range of animal and vegetable food substances contg. vitamin A, as found by animal expts. Parallel results were obtained. The specificity of the color tests has also been studied in detail. When cod-liver oils are examd. with a specially purified $SbCl_3$ reagent, differences in the stability of the vitamin seem to be detectable by observing differences in the color changes. Recent work on cholesterol derivs. (cf. *C. A.* 20, 2341, 3301; 21, 2017, 2722) indicate the possibility that vitamins A and D may be derivs. of the same parent substance. A list of 41 references is added.

S. WALDBOTT

A note on antimony trichloride and some factors affecting its sensitivity as a reagent for vitamin A. FRANK WOKES AND J. R. BARR. *Pharm. J.* 118, 758-60, 793; *Chemist & Druggist* 107, 31-2(1927); cf. Carr and Price, *C. A.* 20, 3030 and preceding abstr.—The $CHCl_3$ used should be dried with anhyd. $CaCl_2$, and be free from H_2O , $COCl_2$, Cl_2 and HCl . Recryst. the $SbCl_3$ from $CHCl_3$ or other anhyd. solvent and store it in a desiccator. In prepg. the solns. avoid heat which may produce free Cl_2 ; this tends to accelerate the reaction between $SbCl_3$ and vitamin A, thus diminishing the sensitivity of the reagent. The latter is also affected by the gradual sepn. of small quantities of a heavy oily liquid, apparently a soln. of $CHCl_3$ in either $SbCl_3$ or some similar Sb compd., analogous to the solns. of H_2O in $PhOH$ found in acidum carbolicum liquidum. The formation of this oily liquid depends on the presence of H_2O , temp. and exposure to air, which factors must be considered in the prepn. and storage of the vitamin reagent. A list of 14 references is appended.

S. WALDBOTT

Some constituents of citrus fruits. STANLEY G. WILLIMOTT AND FRANK WOKES. *Pharm. J.* 118, 770-3, 793; *Chemist & Druggist* 107, 32-3(1927); with 16 references.—Orange, lemon and grape-fruit have been examd. for their various constituents. In view of the theory that these are produced by photosynthetic action in the flavedo, a comparison has been made between their concn. in the flavedo and in the juice. Vitamins were found in all 3 fruits. In general, the juice contains mostly vitamin C, the grape-fruit rather less than the orange and lemon. Vitamin B, on the other hand, is concd. mainly in the flavedo, in considerable quantities. Vitamin A is present in significant quantities only in the orange, both in peel and juice. These variations in vitamin distribution and content led to a study of factors which might affect the vitamins. In particular, the presence of oxidizing enzymes was considered. The essential oils, obtained by expression or by cold extn., have been examd. chemically, especially in regard to the chemistry of vitamin A. Changes in structure, reaction, enzyme and sugar content during ripening were investigated.

S. WALDBOTT

Some less-appreciated constituents of orange juice. S. G. WILLIMOTT. *Pharm. J.* 118, 773-5, 793; *Chemist & Druggist* 107, 33-4(1927); with 25 references.—Orange juice was long considered mainly as a source of vitamin C, equally potent with lemon juice, and the possible presence of other vitamins was overlooked. When vitamin A was first detected in the juice, the quantity present was rather underestd., probably on account of its partial destruction by oxidation. It is shown that the juice of fresh ripe California oranges ("Sunkist" brand), when carefully collected and used, contains much larger quantities of both vitamins A and B than was previously supposed. Vitamin D appears to be absent, although the juice exerts a beneficial action in rickets.

S. WALDBOTT

Studies of the vitamin potency of cod-liver oil. XXI. The stimulation of reproduction by fat-soluble vitamins. A. D. HOLMES, A. W. DOOLITTLE AND W. B. MOORE. *J. Am. Pharm. Assoc.* 16, 518-27(1927).—The birds were Rhode Island pullets. The tests were carried out for 32 weeks. The oil used had a vitamin content of about 1660 units per g. The birds were fed 0.25, 0.5, 1 and 2 cc. of oil while the controls received none. The factors studied were egg productions, wt. of eggs, blood clots, fertility, hatchability, viability of chicks, broodiness, body wt., mortality, flavor of eggs and flesh of the birds and vitamin content of eggs. The egg production was increased, the wt. of eggs was increased slightly, the no. of blood clots diminished as the oil was increased, the no. of infertile and weak germ eggs was diminished, the hatchability was increased, the viability of the chicks was increased, broodiness was not influenced, body wt. of the high producing birds was not decreased and the mortality among the high test birds was decreased over that of the controls. No detectable flavor was given to the flesh or eggs of the birds. The vitamin potency of the eggs increased over that of the controls.

L. E. WARREN

Microbic virulence and host susceptibility on paratyphoid-enteritidis infection of

white mice. XII. The effect of diet on host resistance. IDA W. PRITCHETT. *J. Exptl. Med.* 46, 557-70(1927).—When 5% of butter fat or cod-liver oil is added to a bread-and-milk diet, in itself adequate to promote the breeding and rearing of a healthy stock of mice through a period of years, the resistance of these mice to *per os* infection with the paratyphoid mouse typhoid bacillus as compared to that of mice on the unmodified diet, is definitely increased. A similar effect may be obtained with a McCollum "complete" diet, even when the butter fat is omitted, and with a bread-and-milk diet in which the milk used has been rayed with a Hg-vapor lamp. When an inactive fat, like Crisco, is added to the bread-and-milk diet, the results obtained are not very clear-cut. While seasonal variations in resistance to mouse typhoid were not completely eliminated by the various modified diets, they were nevertheless reduced, the modified diets tending to stabilize the death rate at a point lower than that usually reached by the mice on the control diet.

C. J. WEST

Nutritive value of fats. III. JUN-ICHI OZAKI. *Proc. Imp. Acad. (Japan)* 3, 439-44(1927); cf. *C. A.* 21, 1478, 1479.—Among satd. fats, laurin and myristin had the highest value; from acetin to myristin, the nutritive value increased with the mol. wt. None of the satd. fats tested was so noxious as isovalerin or undecine. Among unsatd. fats, olein gave the best results; with olein, linolin, linolein and iwashin, the nutritive value decreased with the increase of the no. of unsatd. linkings. Those having an unsatd. linking in the α,β -position were generally less nutritious than the corresponding satd. fats. The only exception was isovalerin, which was better utilized than isovaline. Those fats having a triple bond (like stearolin and undecine) were noxious. In general, the fats contg. fatty acids of an even no. of C atoms were better utilized than those having an uneven no. of C atoms. The lower aldehydes have little nutritive value and some exhibited rather noxious effects; the higher aldehydes (margaric, palmitic and pentadecylic) were tolerably well utilized. The esters were, in general, better utilized than the corresponding glycerides; the Na soaps were as well utilized as the glycerides. The nutritive value detd. by feeding expts. coincides fairly well with the absorption coeff.

C. J. WEST

The composition of the urine of steers as affected by fasting. T. M. CARPENTER. *Am. J. Physiol.* 81, 519-51(1927).—Seven fasts with adult steers (about 600 kg.) and 2 fasts with younger steers (about 250 kg.) were studied. The general trend in the rate of elimination of urinary constituents was a falling off, depending upon the previous ration, with the exception of a rise in inorg. sulfates and a marked increase in urea, noted only in fasts after submaintenance feeding. The fasting base line, or the disappearance of the effect of previous food, was reached by the 4th to 6th day. Min. N excretion of the adult steers was from 1.6 to 1.7 g. per hr., and between 0.064 and 0.075 g. per kg. of the body wt. per 24 hrs. Extensive chem. analysis of the various urinary constituents were made.

J. F. LYMAN

A new standard meal for the determination of the specific-dynamic effect of protein. ALFRED WERNER. *Schweiz. med. Wochschr.* 57, 612-21(1927).—Aleuronat, a plant protein product, was used. This has a compn. of 80-85% protein, 8% water, 3-6% starch, 0.1-1% fat, 2-3% alc. ext., mostly lecithin and 1.2% ash. In the last 2 components there was 0.58% P_2O_5 . The dose of aleuronat was 0.5 to 1 g. per kg. The sp. dynamic effect of protein caused by the min. dose averaged 24%. The peak of the curve was reached in 70% of the cases after the second hr., in 30% after the first hr. Knipping's respiratory exchange app. was used. A bibliography of 60 references is appended.

R. C. WILLSON

F—PHYSIOLOGY

E. K. MARSHALL, JR.

Observations on the isolated pyloric segment. A. LIGHTSTONE. *Proc. Soc. Exptl. Biol. Med.* 23, 553-6(1926).—A closed pyloric pouch of a stomach with an external fistula was established in the dog; a gastrojejunostomy permitted normal alimentation. The pyloric secretion was strongly acid to litmus and was unchanged by acetylcholine or by pilocarpine. Adrenaline decreased the secretion.

C. V. B.

The influence of gastric section on gastric secretion. W. H. BARBER. *Proc. Soc. Exptl. Biol. Med.* 23, 557(1926).—The pyloric portion of the stomach continues an acid secretion and its motor function is unimpaired following the section of the vagal or vagosympathetic nerves in the stomach wall.

C. V. B.

Some observations concerning metabolic rate in turtles, *Chrysemys marginata belli* and *Chelydra serpentina* (Linn). FRANCES M. BALDWIN. *Am. J. Physiol.* 76, 196(1926).—Three series of expts. on the painted turtle after being kept in the lab.

for a month without food, on the same species direct from its natural environment and on snapping turtles direct from the water, show the av. figures 604.8, 1169.0 and 1490.2 on the cc. kg./ day basis.

J. B. BROWN

Observations upon the action of the parathyroid hormone. N. B. TAYLOR. *Am. J. Physiol.* **76**, 221-2(1926).—Rabbits, guinea pigs and mice were immune to large doses of the parathyroid hormone. During blood Ca rise there are no symptoms, but upon the development of urgent symptoms there is a fall in blood Ca. From 18 to 24 hrs. after the first injection there is a sharp rise in the titratable acidity of the urine with an increase in NH_3 excretion.

J. B. BROWN

The source of oxalic acid in the animal organism. GAETANO VIALE AND STEFANO CASTAGNA. *Arch. sci. biol.* **9**, 365-78(1927).—It is known that under proper conditions glucose may be oxidized to $(\text{COOH})_2$. The metabolism of glucose was therefore studied. Insulin injections do not affect oxalatenia, but decrease the amt. of $(\text{COOH})_2$ excreted. Adrenaline injections, which produce hyperglucemia, also increase oxalate excretions. Pancreatic deficiency has a like effect. Diabetic conditions therefore produce also oxalaturia. However, in diabetes from fluorescein in which glucose does not increase, there is no increase in $(\text{COOH})_2$. It is, therefore, faulty glucose metabolism which produces $(\text{COOH})_2$. Insulin helps the condition by either preventing $(\text{COOH})_2$ formation, or also by catalyzing its further oxidation to H.COOH , and therefore, $(\text{COOH})_2$ metabolism is regulated by the pancreatic secretions and insulin injection is a rational treatment in oxalemia.

A. W. CONTIERI

The distribution of hydrogen ions between erythrocytes and plasma. ALESSANDRO GEIGER. *Arch. sci. biol.* **9**, 447-58(1927).—When the p_{H} is normal physiologically, the H ions in the erythrocytes and plasma are distributed according to Donnan's theory ($\text{H}^+\text{erythrocytes} \times (-)\text{erythrocytes} = \text{H}^+\text{plasma} \times (-)\text{plasma}$). When an acid condition is present, the H ions are distributed according to the above theory only in the hemolyzed corpuscles.

A. W. CONTIERI

Reversibility in chemistry and metabolism with an attempt to formulate living processes. WOLFGANG PONNDORF. *Beitr. klin. Tuberk.* **65**, 184-92(1926).—Recognizing the importance of reversible reactions in chemistry, P. discusses them in living processes and evolves a working hypothesis for correlating this with reversible reactions of metabolism for the purpose of exptl. elucidation of bodily processes. H. J. C.

Action of p_{H} on gaseous exchange in muscle broth with the continuous presence of phosphatization. M. COMEL. *Atti accad. Lincei* [6], **5**, 808-12(1927); cf. C. A. **21**, 2300.—To study further the cause of diminished respiration with diminished p_{H} , phosphatization was maintained throughout a series of liquids with different p_{H} values. This was obtained (1) by different proportions of Na_2HPO_4 and citric acid, and (2) by different combinations and proportions of H_2PO_4 , NaH_2PO_4 , Na_2HPO_4 and Na_3PO_4 , with the same exptl. technic as before. The results are tabulated to show the relations between p_{H} , consumption of O and production of CO_2 . Respiratory exchange diminished rapidly with decrease in the p_{H} of the liquid below a value approx. at the isoelec. point of the muscle protein, i. e., p_{H} around 5. Above p_{H} 5, the results varied somewhat with the means of phosphatization, but active respiration occurred in all cases. In general respiratory exchange was low with p_{H} values at which the protein was in the state of cations, while the optimum exchange was at neutrality. The results indicate that the fundamental factor governing the exchange is the p_{H} value. C. C. D.

Researches on lime in blood. IX. The action of insulin on the blood lime picture. ESKIL KYLIN. *Z. ges. exptl. Med.* **52**, 260-1; *Chem. Zentr.* **1926**, II, 2609; cf. C. A. **21**, 2728.—After injection of insulin the Ca content of the blood diminishes, and since the Ca content of the *duclux thoracicus* increases, this loss may perhaps be the result of a transfer of Ca from the blood to the lymph.

C. C. DAVIS

The lipid phosphorus content and the physiological activity of the submaxillary gland. R. CAMINADE, ANDRÉ MAYER AND H. VALLEE. *Ann. physiol. physicochim. biol.* **3**, 89-93(1927).—The lipid P in the resting submaxillary gland of dogs is very const., averaging in 9 expts. 0.34 g. per 100 g. dry tissue or 0.082 g. per 100 g. fresh tissue. After moderate physiol. activity the changes in P content are only slight. When the gland is excited by pilocarpine, the tissue has an increased H_2O content but no change in P in the dried gland occurs. However, central or reflex nerve stimulation increases the P content of dried gland but does not change its H_2O content.

H. J. D., JR.

The physiology of the thyroid gland. F. C. KENDALL. *Atlantic Med. J.* **30**, 609-12(1927).—A discussion of the chem. properties, and the physiol. action of thyroxine in relation to thyroid disturbances.

H. J. DEUEL, JR.

Physiology and pathology of lymph formation. ROBERT MEYER-BISCH. *Ergeb.*

nisse physiol. 25, 574-642(1926).—A review including a résumé of recent work on the chemistry of lymph of factors influencing lymph flow, and of lymphagogs.

H. J. DEUEL, JR.

Electrolytic equilibrium of the blood. Modifications of the equilibrium following intravenous injection of potassium salts. L. CONDORELLI. *Arch. farmacol. sper.* 43, 44-50(1927); cf. *C. A.* 21, 2300.—Salts of K injected intravenously are rapidly withdrawn from the circulation and taken up by the tissues. Injection of KCl results in an appreciable diminution of NaCl. In these phenomena of regulation the liver apparently plays an important part. The lethal effect of KCl injection is dependent not so much on the abs. amt. injected as on the concn. and on the rapidity of the injection. With rapid injection there is not time for the reestablishment of electrolytic equil. and a shock similar to anaphylactic shock results. The symptoms are tachycardia, fall of blood pressure, emission of urine and feces, and finally paralysis of the respiration and of the heart. With more moderate increase in blood K the symptoms of tachypnea, tachycardia and fall in blood pressure are less acute and recovery occurs when equil. is again restored.

A. W. DOX

The rapidity of fixation of calcium injected intravenously in animals with the reticulo-endothelial system free or blocked. L. CONDORELLI. *Arch. farmacol. sper.* 43, 88-96(1927).—Ca injected intravenously is taken up with extreme rapidity by the tissues and within 5 min. disappears from the circulation. The tissues are capable of taking up a large amt. of Ca, so that within the limits of the expts. the amt. thus fixed varied with the quantity injected rather than with the wt. of the animal. In animals in which the reticulo-endothelial system was blocked by means of colloidal Ag no diminution of this Ca-fixing power was observed.

A. W. DOX

The iodine content of the thyroid gland of various types of cattle and its relation to the glandular condition. TH. VON FELLEBERG AND H. PACHER. *Mitt. Lebensm. Hyg.* 18, 265-89(1927).—Analyses of 80 different thyroid glands shows little relation between the I content and other conditions of the gland. The I content generally was not dependent upon the size. In certain bovine species, it varied inversely to the gland size. The abs. I content increased with the weight of the gland. A low I value accompanied a low content of colloidal matter and small follicles. Single species showed different thyroid weights and contents, so that external conditions as environment, climate, I, food, etc., may have more effect than actual glandular condition.

R. C. E.

The effects of variations in p_H on the volume of red cells. A. C. HAMPSON AND M. MAIZELS. *J. Physiol.* 62, 16-8(1926); *Physiol. Abstracts* 12, 23.—In K phosphate soln. the min. vol. is found at p_H 8.1. When more acid, the vol. first increased, then decreased to another min. at p_H 3. When more alk., the vol. increased until hemolysis occurred at 11.0. With const. p_H the vol. increased with diln., except in very acid soln. In acid solns. agglutination occurred. The curves obtained correspond to a Donnan equil.

H. G.

Intermediate carbohydrate and fat metabolism in pregnancy. A. GORTSCHALK. *Klin. Wochschr.* 6, 802-4(1927).—The intermediate metabolism of carbohydrates and fats is abnormal in pregnancy. Ketogenic substances are oxidized in preference to carbohydrates. The pregnant organism does not lose its ability to metabolize carbohydrates. The latter are spared for the rapidly developing fetus.

MILTON HANKE

A new antilucosuric substance that is preformed in the body. Gluchorment. CARL V. NOORDEN. *Klin. Wochschr.* 6, 1041-3(1927).—Pancreas tissue is allowed to autolyze until guanidineacetic acid can be demonstrated in the mixture. The material is then free from water. The dry powder is fed. This powder contains only an insignificant quantity of guanidine derivs. They can hardly be responsible for its activity. The mode of prepn. precludes the presence of insulin. Gluchorment is an effective antilucosuric agent. It does not appear to be toxic.

MILTON HANKE

Calcium content of serum during pregnancy, at the time of birth and postpartum. A. BOCK. *Klin. Wochschr.* 6, 1090-1(1927).—The Ca content of the serum is normal (9.6 mg. %) during pregnancy. Values as low as 9.18 mg. % are obtained just before parturition. The values fluctuate considerably at the time of birth but av. about 9.4 mg. %. There is always a low Ca value postpartum (9.2 mg. %) with a slow recovery to normal during the first week.

MILTON HANKE

Copper in human blood serum. OTTO WARBURG. *Klin. Wochschr.* 6, 1094-5(1927).—Human serum contains 0.001 to 0.002 mg. Cu per cc. The methods of detn. are described.

MILTON HANKE

Glucose, the hormone that stimulates the secretion of insulin. E. GRAFE AND F. MEYTHALER. *Klin. Wochschr.* 6, 1240(1927).—Injection of 3-4 g. glucose in 5 cc. H₂O into the femoral artery, the hepatic artery or the portal vein, leads to a marked

hyperglucemia. A similar injection into the arteria pancreaticoduodenalis leads either to a very slight hyperglucemia, no effect at all or a pronounced hypoglucemia. Glucose is the hormone that stimulates the pancreas to secrete insulin. MILTON HANKE

Ovum and hormone. BERNHARD ZONDEK AND S. ASCHHEIM. *Klin. Wochschr.* 6, 1321-2(1927).—Irradiation of the ovaries of mice destroys the maturing ova and leads to changes in the tissue such that new ova are not produced; but the phenomena of estrual crisis are not inhibited. The maturing ovum is evidently not the stimulus that leads to the production of the ovarian hormone. Conversely, injection of the ovarian hormone does not lead to folliculation or to premature ripening of the ova in infantile mice, although it does lead to estrual crisis. Thallium inhibits the production of ovarian hormone in mice. The ovaries contain maturing ova and large follicles; but there is no estrual crisis. The injection of an ext. of the anterior lobe of the hypophysis leads to an estrual crisis within 100 hrs. The hypophyseal ext. is the activator that leads to corpus luteum formation, folliculation, production of ovarian hormone and, hence, to estrual crisis. MILTON HANKE

Is the amino acid content of the blood changed during the gestation period under normal and under pathological conditions? CARL HELLMUTH. *Klin. Wochschr.* 6, 1507-8(1927).—There is no change in amino acid content of blood during gestation. MILTON HANKE

Hormone production after administration of glucose. IV. Demonstration of insulin in blood after the peroral administration of glucose in man. H. HAUSLER AND R. WEBER. *Klin. Wochschr.* 6, 1521-2(1927).—Administration of glucose leads to an increased secretion of insulin in man. This does not occur if atropine is given prior to the glucose administration. MILTON HANKE

Amount of active principle of the hypophysis present in cerebrospinal fluid in normal and in pregnant women. F. SIEBERT. *Klin. Wochschr.* 6, 1558-60(1927).—Cerebrospinal fluid normally contains a demonstrable quantity of the active principle of the hypophysis. This is somewhat reduced during the last months of pregnancy, remains low during the period of delivery and is elevated during the two weeks after delivery. MILTON HANKE

Estrus in rats after parabiosis. H. ZACHERL. *Klin. Wochschr.* 6, 1614-15(1927).—A "Colioanastomosis" between two female rats has no effect upon their respective estrual periods. Pregnancy in one of the rats does not interfere with the regularity of the estrual periods in the other. Parabiosis of a male with a non-pregnant female soon leads to a complete cessation of estrus in the female. This endures for the entire period of anastomosis and persists for some time after the animals are sepd. Anastomosis of no male females with castrated males or females leads to profound changes in the reproductive organs of both animals. The changes are described in detail. M. H.

Acid-soluble iron in blood serum. GEORG BARKAN. *Klin. Wochschr.* 6, 1615(1927).—Ionizable Fe can be dialyzed out of serum that has been treated with an equal vol. of 0.8% HCl. The iron so liberated represents about 0.4% of the total blood iron and about 6% of the amt. that can be liberated from whole blood by the identical process. MILTON HANKE

Urea formation in the organism. I. Urea formation during liver perfusion and autolysis. GIUSEPPE SUNZERI. *Ann. clin. med. sper.* 16, 207-23(1926); *Ber. ges. Physiol. exptl. Pharmacol.* 41, 60.—The perfusion was made with Ringer soln. and defibrinated blood. There was always an increase of NH_3 after blood perfusion, regardless of whether the liver was removed after feeding or hunger or pancreatectomy with subsequent hunger. Urea was always formed (21.8-51.4%). The max. values were obtained on blood perfusion after feeding, but the faculty of forming urea from parenchymatous tissue was present in any condition. The amt. of urea produced on autolysis of the liver removed during digestion varied, but generally increased with the progress of autolysis. In hunger or after pancreatectomy the urea did not change during autolysis. MARY JACOBSEN

Reinjection of blood of the same organism. II. Modification of a few physico-chemical properties. F. SCIPLINO AND L. LA GRUTTA. *Arch. pathol. sper.* 1, 455-69(1926); *Ber. ges. Physiol. exptl. Pharmacol.* 40, 693-4.—The effect of reinjection into a dog of his own blood or its constituents differs from that of foreign protein injection. The cond. rose after the injection of washed red cells (I) and was lowered by serum (II), whole (citrate) blood and serum contg. both glucose (III and IV) and glucose alone (V). η was increased by defibrinated blood (VI) and (less distinctly) by II; it was diminished by I, III, IV and V. The viscosity was raised by VI and lowered by I to V. The surface tension was lowered by VI, by citrated blood and by citrate soln. and raised by I, II, IV, and whole blood. MARY JACOBSEN

Displacement of the isoelectric points of the plasma and variations of the sedimentation velocity of erythrocytes. P. H. ROSSIER. *Arch. phys. biol.* 5, 222-9(1926).—The sedimentation velocity increases with the p_H of the isoelec. point α . M. J.

Relation between thyroid function and enzyme content of the blood serum. S. NAKAMURA. *Folia endocrinol. japon.* 2, 6-7, 87-119(1926); *Ber. ges. Physiol. expil. Pharmacol.* 41, 99-100.—Thyroid feeding increases the serum trypsin of rabbits and diminishes antitrypsin and lipase. Thyroidectomy reduces the serum trypsin of rabbits and the antitrypsin and mostly also the lipase. MARY JACOBSEN

The effect of internal secretions on the gaseous metabolism and the mutual relations of the internal secretions. K. KITA. *Folia endocrinol. japon.* 2, 15-6, 332-64(1926); *Ber. ges. Physiol. expil. Pharmacol.* 41, 97.—The increase of the respiratory quotient in alimentary hyperglucemia is prevented by *adrenaline* and *pituitrin* and favored by *insulin*. *Thyroxin* promotes the gaseous metabolism in normal and thyroidectomized animals, while *thyreoglandol* has but a slight effect. The action of *adrenaline* is inhibited by large *pituitrin* doses, that of *insulin* by *adrenaline*. *Thyroxin* and *pituitrin* are synergists, particularly with regard to the depression of the R. Q. Changes of blood sugar are detd. not only by mobilization of glycogen but also by the oxidation of sugar. MARY JACOBSEN

Effect of thyroid on the bone growth of young rats. S. NISHIMURA. *Folia endocrinol. japon.* 2, 42-3, 153-220(1926); *Ber. ges. Physiol. expil. Pharmacol.* 41, 100.—Thyroid feeding as well as thyroidectomy inhibits the growth of the long bones as indicated among others by the narrowing of the epiphyseal cartilage. The histological details characteristic of growth disturbances are given. The Ca content of the bone is increased by thyroid feeding and reduced by thyroidectomy, while its wt., vol. and water content are diminished by both. MARY JACOBSEN

An unknown aspect of the physiology of the placenta. G. CHAPPAZ. *Gynecol. et obstet.* 15, 39-43(1927); *Ber. ges. Physiol. expil. Pharmacol.* 40, 828.—In over 50 cases the fetal blood showed a greater f.-p. depression than the maternal: retroplacental artery 0.52°, funicular vein 0.54°, funicular artery 0.56°. MARY JACOBSEN

Physiology of the thyroid and parathyroids. III. The effect of thyroid and parathyroids on the creatine-creatinine metabolism. YOSIZO TAKAHASHI. *Okayama Igakkai Zasshi* 1926, 1171-83; *Ber. ges. Physiol. expil. Pharmacol.* 40, 563.—In dogs thyroidectomy (I) causes a decrease, parathyroidectomy (II) and thyroparathyroidectomy (I-II) a slight increase of blood sugar. The tolerance for intravenously injected glucose is lowered in II and I-II and distinctly increased in I. The hyperglucemia lasts in I longer than either in II, I-II or in the controls. The creatine-creatinine excretion is distinctly promoted by thyroid feeding and substantially lowered in the absence of thyroid. During the stage of latent tetany in II the urine creatine is lowered, while the creatinine remains normal; in I-II both are lowered. In the tetanic stage the creatine-creatinine excretion increases in II and in I-II, that of creatine drops to almost zero. MARY JACOBSEN

Fixation and oxidation of sulfur in the liver. R. GARCIN AND A. LESURE. *Progres med.* 55, 9(1927); *Ber. ges. Physiol. expil. Pharmacol.* 40, 233.—The liver has a high S content, 50% of which is oxidized S. A considerable part is extractable with $CHCl_3$. Proof of S fixation and oxidation is seen in the fact that the total S content of portal blood is higher than that of the hepatic vein, while the reverse obtains for the oxidized S. S is supplied partly by the food and partly by hemolytic processes in the spleen. This accounts for the abnormally high liver S in bronzed diabetes. In liver diseases in which the S oxidation is inhibited an excess of neutral S passes into the blood. M. J.

Function of placenta. I. Carbohydrate metabolism. II. The effect of insulin on the carbohydrate metabolism of isolated and surviving placenta. GIUSEPPE DELLEPIANE. *Riv. ital. ginecol.* 5, 89-100(1926); *Ber. ges. Physiol. expil. Pharmacol.* 40, 828.—Insulin considerably increases the glucolytic (I) and glycogenolytic (II) power of the placenta (Ringer-fetal blood perfusion). In the presence of glucose insulin increases I and lowers II while the glycogen formation is not altered. III. Enzyme action in carbohydrate metabolism attributed to placenta. *Ibid* 216-40.—Considerable glycogenolysis occurs on aseptic autolysis of fresh placental tissue. The absence of glucolysis and glycogen formation indicates that these activities are detd. by a vital function rather than by the action of preëxisting enzymes. Intravenous injections of placental exts. lower the blood sugar. Placental tissue and ext. have a considerable amylolytic power but do not hydrolyze saccharose or lactose. IV. The action of the maternal surface of isolated and surviving placenta on sugar solutions. *Ibid* 328-37.—When the maternal surface of surviving placenta perfused with a sugar-free soln. is brought into contact with a sugar soln. the content of the latter is lowered by 43% while the glucose of both

placenta and perfusate are not affected. With non-surviving placenta the glucose soln. loses only 13.2%, while the sugar content of the placenta is slightly increased. Conclusion: The maternal surface of the placenta shows a selective absorption for glucose. The glucolytic activity of the placenta is limited to the sugar absorbed in this manner. The placenta actively regulates the carbohydrate metabolism between mother and fetus.

MARY JACOBSEN

Influence of placenta on the effect of adrenaline on the puerperal uterus. K. TANI AND F. HAZAMA. *Kinki Fujinkwa Gakkwai Zasshi* 9, 65-70(1926); *Ber. ges. Physiol. exptl. Pharmacol.* 40, 827 8.--A favorable effect of placenta on the involution of the uterus was suggested by the fact that herbivora, like rabbits, eat the placenta after parturition. Feeding of placenta inverted the action of adrenaline, atropine, pilocarpine and BaCl_2 on the isolated rabbit uterus. A closer study of the inverted adrenaline effect led to the conclusion that placenta promotes the involution of the puerperal uterus by stimulating contractions. The action is probably an indirect one, through the ovaries and adrenals.

MARY JACOBSEN

Application of a few physicochemical facts to the analysis of the salivary reflex. A. ČERNÍKOV AND B. BAJANDUROV. *Zurnal eksper. biol. mediciny* 4, 396-418(1927); *Ber. ges. Physiol. exptl. Pharmacol.* 41, 69.--The different effects of repeatedly applied salivary stimuli are in the first instance detd. by the chem. nature of the stimulant. Repeated application of alkalies reduces salivation to zero. Under the same conditions inorg. acids in great dilns. cause a decrease, in higher concns. an increase followed by depression. Org. acids stimulate salivation only in higher concns. Repeated application has the same effect as that of inorg. acids in higher concns. The action of all acids is characterized by a curve with an ascending and a descending limb. Salts of org. and inorg. acids have a slight, nonelectrolytes (sugar, glycerol) no, stimulating action. The cation is the active constituent; H is the most effective. Anions, especially OH , modify the permeability of the lingual mucosa and thus may invert the nature of salivary reflex. By increasing the permeability of the tongue mucosa OH makes stimulation by the otherwise inactive Ca and Mg ions possible. The stimulating effect of acids may be essentially reduced by previous application of Ca. Here too Mg acts as an antagonist of Ca.

MARY JACOBSEN

Endocrine glands and enzymes of the blood. I. The influence of potassium iodide, iodine, and iodated albumin on the catalase of the blood. O. A. STEPPUN AND A. M. TIMOFEEVA. *Trans. Sci. Chem. Pharm. Inst.* 1923, No. 3, 3-18.--Twenty cc. of blood from the vein of a rabbit ear was dild. with 18 cc. H_2O and after keeping in an incubator at 37° for 1-1.5 hrs., 6-cc. portions were poured into small Erlenmeyer flasks. To the first flask 1 cc. of H_2O was added, to the others an equiv. quantity of a soln. of KI 6:1000 and I 3:1000 in a KI soln. of 6:1000 was added. All the flasks were kept in an incubator for 30 min. and the catalase index was detd. by the Bach method. Various quantities of the I solns. were used. The test showed that KI has no influence on the catalase index of the rabbit blood. The I solns. exerted a pronounced influence, decreasing the catalase capacity, even with the lowest concns. Iodated albumin, free from free I, showed the same effects as I.

J. S. JOFFE

The digestion of "intact" plant cells and its significance for the physiology and pathology of digestion in man. I. Introduction. J. STRASBURGER. *Arch. Verdauungskrankh.* 41, 1-11(1927).--Discussion. II. Digestion of starch from "intact" cells. LEO STRAUSS. *Ibid* 11-23.--The starch contained in unbroken cells is digested in the intestine.

FRANCES KRASNOW

Chemical analysis of blood on forty-eight normal individuals. I. CONCEPCIÓN AND M. OCAMPO. *J. Philippine Islands Med. Assoc.* 7, 143-53(1927).--The av. figures obtained were non-protein N 29.1 mg., urea N 14.5 mg., preformed creatinine 1.5 mg., sugar 107.2 mg., NaCl 471 mg., per 100 cc. of whole blood.

FRANCES KRASNOW

The effect of diathermy on metabolism. ZDENKO STARY. *Z. Biol.* 85, 138-50 (1926).--By means of diathermy it is possible to decrease the temp. gradually or to suppress it entirely, thereby lowering the metabolism to a min. with the production of "Vitalwärme" only. If the body temp. is increased through the application of greater amts. of diathermic treatment, the energy exchange is increased despite rapid cessation of application. Although urethan narcosis injures the chem. thermo-regulating mechanism in rabbits, small quantities of diathermic application cause an increase in metabolism. Cf. following abstr.

FRANCES KRASNOW

Effect of diathermy on metabolism. II. Z. STARY AND W. P. STEIN. *Z. Biol.* 85, 551-6(1927).--The qual reactions due to diathermic treatment are the same in man as in rabbits. Quantitatively man suffers a lesser effect.

FRANCES KRASNOW

The effect of thyroid gland extract on the sensitiveness of the cervical sympathetic system. W. E. MAJEWSKY. *Z. Biol.* 85, 342-8(1926).—Physiological. F. K.

Chemical and polarimetric observations on glucose and salts solutions recovered from Thiry-Vella loops. H. L. WHITE AND J. RABINOWITCH. *J. Biol. Chem.* 74, 449-54(1927).—No evidence of a mutarotation of a 2% glucose soln. was found in 30 to 40 min. following a stay of 10 min. in the intestinal loops of 2 Thiry-Vella fistula dogs. Hewitt and Pryde's findings (*C. A.* 14, 3098), from which they infer a γ -glucose formation, are thus not confirmed. The dogs used had been operated on about 4 months before the expts. were performed and were in excellent condition. A. P. L.

The fate of sugar in the animal body. VII. The carbohydrate metabolism of adrenalectomized rats and mice. C. F. CORI AND GERTY T. CORI. *J. Biol. Chem.* 74, 473-94(1927); cf. *C. A.* 21, 3071.—A study has been made of the influence of insulin on the carbohydrate metabolism of animals without, or at least with the min. of, epinephrine secretion, since several reports have been made to the effect that insulin injections lead to an increased discharge of epinephrine. "When rats surviving double adrenalectomy were subjected to a 24-hr. fast, the liver glycogen disappeared and the blood sugar fell considerably below normal. In contrast to the liver glycogen, the glycogen content of the muscles of these animals remained the same as that of normal control rats fasted for the same length of time. The low blood sugar is linked with the lack of liver glycogen, since the muscle glycogen does not participate in blood sugar regulation. The absence of liver glycogen in fasting adrenalectomized rats is not the result of a disturbance in the synthesis of sugar into glycogen, since liver glycogen is formed at the normal rate when glucose is fed. Twenty-four fasting adrenalectomized rats absorbed glucose at a much slower rate than 24-hr. fasting normal rats. During 4 hrs. of glucose absorption the adrenalectomized rats *without insulin* oxidized 373 mg. of glucose and formed 270 mg. of glycogen (124 mg. in the liver and 146 mg. in the rest of the body). The adrenalectomized rats *receiving insulin* injections oxidized 471 mg. of glucose and deposited 37 mg. of glycogen in the liver and 185 mg. in the rest of the body. The difference in liver glycogen corresponds closely to the difference in glucose oxidation of 98 mg., while the glycogen deposition in the rest of the body (chiefly muscles) is not materially changed. The same results have been obtained previously on rats with intact adrenals, where a discharge of epinephrine in sufficient amts. to produce a metabolic effect could not be excluded. Since the adrenals were absent in the present expts., the conclusion has been drawn that the lessened deposition of liver glycogen and the increased sugar oxidation, also to be observed in insulinized rats with intact adrenals, are due to insulin alone and not to a combined action of insulin plus epinephrine. Previous expts. have shown that insulin injections lead to a decrease in the liver glycogen of fasting insulinized mice. An identical result has been obtained on mice from which both adrenals had been removed 20 to 30 days previously. The adrenalectomized mice without insulin showed 2.16% liver glycogen after a fasting period of 1-5 hrs. The adrenalectomized and insulinized mice that were killed simultaneously showed only 0.79% liver glycogen. Since the effect of insulin on the liver glycogen of fasting animals is the same, whether or not the adrenals are present, there is no need to assume that epinephrine is responsible for the decrease in liver glycogen following insulin injections."

A. P. LOTHROP

The nitrogenous constituents of hen urine. R. E. DAVIS. • *J. Biol. Chem.* 74, 509-13(1927).—Urine was obtained by a special technic so that it was uncontaminated by feces. In 14 expts. with 5 hens the following min., av. and max. per cents of the total N were obtained for certain of the nitrogenous constituents, resp., uric acid N 59.4, 62.9 and 69.5; NH_3 N 14.9, 17.3 and 19.5; urea N 9.2, 10.4 and 11.2; creatine-creatinine N 7.1, 8.0 and 9.1. The av. abs. amts. in mg. per 100 cc. of urine were as follows: total N 100, uric acid N 62.9, urea N 10.4, NH_3 N 17.3, creatine-creatinine N 8.0, undetd. N 1.4. Since an unknown amt. of reabsorption of urea, creatine and creatinine probably occurs in the cloaca of the hen, it does not seem practical to calc. urinary N from the amt. of uric acid in hen droppings by multiplying uric acid N by some factor.

A. P. LOTHROP

The effects of respiratory gases upon the density of blood and other fluids. W. F. HAMILTON AND H. G. BARBOUR. *J. Biol. Chem.* 74, 553-6(1927).—Whole blood, serum, alk. salt soln. (NaCl 0.7 and NaHCO_3 0.2%) and H_2O were equilibrated with various mixts. of CO_2 , N_2 and O_2 . A given amt. of CO_2 increased the density in this order: H_2O < alk.-salt soln. < serum < blood. O_2 caused a still greater increase. The effect is explained on the assumption that when CO_2 goes into the liquids, it changes their resp. vols. to a different extent. In serum the formation of acid-protein results in more compact mol. arrangements. The shrinkage which occurs when O_2 is added to whole blood

indicates that oxyhemoglobin has a more compact mol. than reduced hemoglobin.

A. P. LOTHROP

The plasma proteins of normal dogs. C. W. MATTHEW. *J. Biol. Chem.* **74**, 557-60(1927).—The min., av., and max. concn. of the plasma proteins in 50 normal dogs were, resp., total protein 6.56, 7.23 and 8.17; fibrin 0.33, 0.45 and 0.68; albumin 4.13, 4.64 and 5.57; globulin 1.78, 2.12 and 2.90; plasma vol. 42.1, 60.0 and 74.4%. The proteins remain const. in any one animal for several days. Venous blood was drawn from the heart by cardiac puncture, thereby eliminating stasis which has been shown to increase the concn. of the plasma proteins.

A. P. LOTHROP

Effects of dialysis and of ether extraction on the diffusibility of calcium in human blood serum. R. F. LOEB AND EMILY G. NICHOLS. *J. Biol. Chem.* **74**, 645-9(1927); cf. *C. A.* **20**, 1244.—A comparative and simultaneous study of Ca concns. at equil. in a dialysis system has been made on human sera divided into the following fractions: whole serum, the same serum rendered Ca-free by preliminary dialysis, the same whole serum extd. with Et₂O. The observed Ca concns. in all 3 fractions are considerably higher than can be accounted for by the Donnan equil. The deviation appears to be slightly greater than in whole sera with the Et₂O-extd. sera and slightly lower in the fractions rendered Ca-free by preliminary dialysis. The results substantiate the idea that there are unionized Ca-protein complexes in human sera and that if there are any non-protein factors present their influence must be quant. very small.

A. P. L.

The effect of adrenaline on phosphorus partition in muscle. J. SACKS. *Am. J. Physiol.* **81**, 276-9(1927).—The injection of adrenaline into rabbits produced a marked increase in inorg. P of the muscle, but little or no change in inorg. P + lactacidogen P.

J. F. LYMAN

The effect of the follicular hormone on old albino rats. J. R. SLONAKER. *Am. J. Physiol.* **81**, 323-35(1927) The hormone did not prolong the productive sexual life by inciting ovulation, but it did stimulate mating activities.

J. F. LYMAN

The thyroid apparatus. XLVII. The cyclic character of the response to parathyroid deficiency. F. S. HAMMETT. *Am. J. Physiol.* **81**, 349-54(1927); cf. *C. A.* **21**, 2020.—Body growth and tooth calcification in the parathyroidectomized rat run a cyclic course of retardation and acceleration.

J. F. LYMAN

Muscle glycogen as a source of blood sugar. S. SASKIN. *Am. J. Physiol.* **81**, 382-91(1927).—After removal of the liver the blood sugar level steadily fell and was not raised by the administration of Et₂O, adrenaline or by asphyxia. Muscle glycogen does not appear to be available as a source of blood sugar in the absence of the liver.

J. F. LYMAN

The alleged antagonistic action of the internal secretions of the pancreas and the thyroid. H. WOLFSON. *Am. J. Physiol.* **81**, 453-9(1927).—There was no disappearance of the symptoms of pancreatic diabetes following thyroparathyroidectomy.

J. F. LYMAN

The regulation of respiration. IX. The relation of tissue acidity and blood acidity to volume flow of blood as illustrated by hemorrhage and reinjection. A. B. HERTZMAN AND R. GESELL. *Am. J. Physiol.* **81**, 563-78(1927); cf. *C. A.* **21**, 2926.—Hemorrhage elicited increased alk. of the arterial blood of anesthetized dogs, increased the acidity of the venous blood, decreased O₂ consumption and increased pulmonary ventilation. Reinjection increased the acidity of the arterial blood and decreased the acidity of the venous blood. This was accompanied by increased O₂ consumption and decreased pulmonary ventilation. Hemorrhage probably increased the acidity of and reduced oxidation in the respiratory center. The theory of acid control of respiration is supported.

J. F. LYMAN

The role of tissue in maintaining acid-base equilibrium of blood. I. The effect of isolated muscle tissue. L. N. KATZ AND M. G. BANUS. *Am. J. Physiol.* **81**, 628-43(1927).—Blood perfused through the isolated gastrocnemius muscle of the dog showed no measurable exchange of Cl or bases between the blood and the muscle, even though the blood used had been acidified with HCl. A lack of permeability of the muscle tissue is indicated. A new form of perfusion app. is described. II. Effect of hind leg preparation. M. G. BANUS AND L. N. KATZ. *Ibid* **81**, 644-9(1927).—When the isolated hind leg of the dog was perfused with whole blood acidified with HCl a decrease in acidity and CO₂-combining power was noted. Some of the tissues of the hind leg, not muscle, increase the buffering capacity of the blood perfused through them.

J. F. LYMAN

The effect on the circulation in man of rebreathing different concentrations of carbon dioxide. J. D. GOLDSTEIN AND E. L. DUBOIS. *Am. J. Physiol.* **81**, 650-60

(1927).—The systolic pressure, the diastolic pressure and the heart rate showed a characteristic relationship to the changes in the alveolar CO_2 tension. J. F. L.

Attempts to increase experimentally the hormone output of the thyroid gland. L. HEKTOEN, A. J. CARLSON AND R. SCHULHOF. *Am. J. Physiol.* 81, 661-4(1927).—In expts. on 9 dogs, sympathetic nerve stimulation, direct thyroid massage and intravenous administration of adrenaline and pilocarpine failed to increase the thyroglobulin in the blood of the thyroid vein above that of the variations in the controls. In one expt. stimulation of the sympathetic nerve was followed by an increased thyroglobulin concn. greater than in the controls. J. F. LYMAN

Gastric digestion. The relation of volume, hydrogen-ion concentration and buffer capacity of the test meal to gastric contents. W. A. STANDISH, G. R. COWGILL AND A. T. SHOHL. *Am. J. Physiol.* 81, 696-706(1927).—Expts. on 2 dogs with gastric fistulas and using test meals of milk powder (Dryco) in water showed that gastric secretion produces stomach contents with an acidity between p_H 4.1 and 3.9 in 30 min. The amt. of 0.1 N HCl secreted in the first 30 min. of digestion varied between 28 and 112 cc. Since all meals reached approx. the same p_H at the same time a regulatory mechanism is indicated, whereby secretion is inhibited after a definite acidity is reached. Also the vol. and buffer value of the meal must have a direct influence on the amt. of secretion of gastric juice. As the contents left the stomach, materials of nearly const. compn. remained until the end of digestion was approached. A given meal is most rapidly digested when it is concd. in small vol. J. F. LYMAN

Kidney function. I. Renal excretion with special reference to Ambard's laws. B. S. WALKER AND A. W. ROWE. *Am. J. Physiol.* 81, 738-54(1927) —The first law of Ambard was correct within certain rather narrow limits; the second proved completely invalid; while the third law, a combination of the 2, fitted the data approx., viz., $Ur / \sqrt{D \times 70/P} \times \sqrt{C} \sqrt{25} = K$. Ur = g. urea per l. blood plasma, D = g. urea excreted per 24 hrs., P = body wt. in kg., C = g. urea per l. urine. II. The relation of blood to urine urea. *Ibid* 755-64.—Data of the writers and others have been subjected to statistical analysis and a mathematical expression for the curve of elimination of urea was derived, viz., $Ur = 0.340D^{0.72379}$. A test of renal efficiency is proposed as follows: The urine collection is made over a period of 1 or 2 hrs. Blood is taken at the middle of the period and urea detd. in blood and urine. The index figure is calcd. from the formula $\sqrt{D}/Ur \times 7.5 = \text{Index}$. D = g. urea per 24 hrs. Ur = g. urea per l. plasma. Normal individuals have an index of 100 or over. An index below 75 is regarded as abnormal; while an index between 75 and 100 is suspicious. J. F. LYMAN

The failure of histamine to induce estrous changes in spayed rats. P. M. LEVIN. *Am. J. Physiol.* 82, 19-21(1927).—The use of histamine offers nothing positive concerning the action of the estrous-inducing principle. J. F. LYMAN

The physiology of the pancreas. III. A hormone for external pancreatic secretion. A. C. IVY, J. I. FARRELL AND H. C. LUETH. *Am. J. Physiol.* 82, 27-33(1927); cf. *C.A.* 21, 164.—The application of acid (0.1 N to 0.05 N HCl) to transplanted loops of jejunum excited secretion in pancreatic transplants. This is thought to prove that acid causes the intestinal mucosa to give off a hormone for external pancreatic secretion. J. F. L.

Absorption from serous cavities. VI. The effect of ligation of the mediastinal lymphatics on absorption from the peritoneal cavity. R. S. CUNNINGHAM. *Am. J. Physiol.* 82, 59-62(1927).—The fact that obstruction of the lymphatic drainage of the diaphragm had no effect on the absorption of isotonic solns from the peritoneal cavity indicates that the absorption of such solns. takes place through the blood vessels. J. F. LYMAN

The role of the hypophysis in the initiation of labor. H. B. VAN DYKE AND A. KRAFT. *Am. J. Physiol.* 82, 84-90(1927).—Cerebrospinal fluids from pregnant women showed no increase in oxytocic substance with the progress of gestation. J. F. L.

Regulation of respiration. X. Effects of carbon dioxide, sodium bicarbonate and sodium carbonate on the carotid and femoral flow of blood. D. W. BRONK AND R. GESELL. *Am. J. Physiol.* 82, 170-80(1927); cf. *C. A.* 21, 2926.—Administration of CO_2 increased the blood flow in the carotid and decreased the femoral circulation. Both NaHCO_3 and Na_2CO_3 increased the carotid and femoral flow of blood. J. F. L.

The occurrence of complex carbohydrates in the blood. I. The effect of takadiastase and emulsin on the reducing power of the blood. E. GABBE. *Biochem. Z.* 187, 57-71(1927).—The reducing power of the blood from humans and rabbits increases 30-40% under the influence of takadiastase. This increase is observed only when whole blood is studied, and not with isolated plasma. If red cells alone are used the increase is much more significant. The substance which undergoes hydrolysis with

takadiastase remains intact when the corpuscles are washed 3-6 times with isotonic NaCl. Expts. with emulsin give practically the same results but not as pronounced as with the takadiastase.

S. MORGULIS

Observations on the gastric secretion in health. T. A. BUTCHER. *Quart. J. Med.* 19, 455-78(1926).—The curve of pepsin secretion corresponds in shape to that of free HCl when this is present. The pepsin curve does not give a true indication of the quantity of pepsin present unless all samples are brought to the same acidity. If this is done the curve is proportional to the quantity of gastric secretion and conforms in shape to that of the total chlorides. Pleasing psychic stimuli increase the secretion of both pepsin and HCl. Nausea and distaste may cause a great diminution in secretion. Atropine by mouth, before a gruel test meal or before psychic stimulation, diminishes the secretion of both pepsin and HCl.

JOHN T. MYERS

Coagulation of blood. H. DE WAELE. *Presse méd.* 90, 1110(1926); *Colloïdes biol. clin. therap.* 1, 79; *Ann. physiol. phys. chim. biol.* 3, 94-112(1927).—D. considers that the fibrinogen of the blood is a fibrinogenate of Ca, or preferably of Ca and Na. The proportions of these cations are a function of the p_H . The soly. of these complexes exhibits a min. towards $p_H = 4$ and another towards $p_H = 7-9$. Evolution of CO_2 with the consequent alkalization gives a p_H of slightly over 7.4, at which the fibrinogen is less sol., and results in the formation of a gel.

A. PAPINEAU-COUTURE

The thiopepsic and thio-oxidizing function of the liver. M. LOEPER, R. GARCIN AND A. LESURE. *Prog. méd.* 1927, No. 1, 9; *Bull. soc. hyg. aliment.* 15, 108(1927).—The S present in the liver comes from ingested food through the intestines and mesenteric vessels, and from hemolysis through the spleen. Nearly 50% of this S is oxidized, which is a much higher proportion than is usually found in the other organs. The fixation and oxidation of S by the liver is also shown by comparative analysis of blood from the portal and subhepatic veins. The S is partly used by the liver in building up its pigment.

A. PAPINEAU-COUTURE

The prenatal growth of the mouse. E. C. MACDOWELL, E. ALLEN AND C. G. MACDOWELL. *J. Gen. Physiol.* 11, 57-70(1927).—The course of prenatal growth in the mouse, guinea pig and chick can be expressed as a linear relation between the logs. of wt. and age only when age is counted from the beginning of the embryo proper. Growth prior to the embryo proper is essentially different than after that time. Methods are described, and other physiol. results are given.

C. H. R.

Microchemical studies on the nervous system. Sulfur and phosphorus content of the cerebral hemispheres of the guinea pig. R. M. MAY. *Compt. rend.* 185, 368-70(1927).—Detns. of S and P by recent micro-methods in the cerebral hemispheres of the guinea pig show practically the same content in each hemisphere. This fact releases one hemisphere for other detns.

L. W. RIGGS

Liquid exchange. II. Venous obstruction edema in dogs with sound and with diseased kidneys. TOMOTAKA YAMAGUCHI. *Tohoku J. Exptl. Med.* 9, 73 110(1927); cf. C. A. 21, 2929.---The conditions under which blood becomes concd. by the passage of some of its constituents into the tissue liquid, or dild. by the passage of more dil. tissue liquid into the blood, are discussed.

L. W. RIGGS

The arginine content of spleen. V. S. GULEVICH AND S. YA KAPLANSKIĖ. *J. Russ. Phys.-Chem. Soc.* 58, 620 2(1926).—Fresh exts. of bovine spleen were treated according to Gulevich and Yohkelson (*Z. physiol. Chem.* 30, 533(1900), no arginine being found. Autolysis of the spleen liver and muscle tissue at room temp. was followed by making non-protein N detns. at intervals. Muscle showed a 3.4% gain in N content in 9 hrs.; liver, 2.4% in 6 hrs., and spleen, 2.2% in 3 hrs. (8.8% in 6 hrs.). The presence of arginine reported by G. and Y. (*Ibid*) was due to the autolysis of spleen tissue during several days' standing at room temp.

BASIL C. SOYENKOFF

The origin of heat of muscle contraction. O. MEYERHOFF AND K. LOHMANN. *Naturwissenschaften* 15, 670(1927); cf. C. A. 20, 1261.---During muscle activity primary heat of 390 cal. per g. lactic acid (anaerobic) is evolved. The glycogen into lactic acid transformation during this phase has only a 185 cal. heat effect, calorimetrically detd. in cut-up muscle. The surplus heat can be partly explained up to 80 cal. by deionization heat of the alkali protein; the remainder of about 120 cal. was so far unaccounted for. It was now found that the labile phosphagen (phosphate-creatine compd.) in the muscle, which could be isolated to 90% purity and was found to consist of $(OH)_2O.P.NH.C(NH).N(CH_3).CH_2.CO_2H$ (mol. wt., titration and kinetic evidence), evolves 150 cal. per g. of phosphoric acid on enzymic cleavage. During muscle activity the ratio of phosphagen decompn. to lactic acid formation is not const. but decreases with increasing fatigue, being initially 1.5 (g. H_3PO_4 : g. lactic acid). For moderate fatigue, 0.2% lactic acid, the ratio is 0.75, which corresponds to an additional heat evolution

of between 120 and 130 cal. per g. lactic acid. Apparently, at least for vertebrae, the energy for anaerobic muscle work is partly due to phosphagen cleavage and not solely to carbohydrate decompn. In lobster muscle a substance of similar chem. and physiol. properties was found. It is characteristic of the phosphagen cleavage that on addn. of O the substance is regenerated.

Histological evidences of colloid absorption directly by the blood vessels of pars anterior of the human hypophysis. A. T. RASMUSSEN. *Quart. J. Exptl. Physiol.* 17, 149-55(1927).—Colloid in the blood vessels was revealed in only 2 of 100 hypophyses examd.

The reaction of human mixed saliva. G. J. RICH. *Quart. J. Exptl. Physiol.* 17, 44-56(1927).—Fresh human saliva, taken under conditions to prevent the loss of CO_2 , is very close to neutral but it is more often acid than alk.

The excretion of water by the kidneys of frogs. E. F. ADOLPH. *Am. J. Physiol.* 81, 315-24(1927).—At 20° the av. normal rate at which frogs excreted H_2O (immersed in tap water) was 1.3% of their wt per hr. This rate was doubled or trebled for every increase in temp. of 10° . At 1° very little urine was secreted. Frogs removed from water to moist air formed no urine. Placed in solns. of NaCl of varying concns. up to 0.1 M there was no effect of the salt on urine formation. Frogs urine was very dil. and never hypertonic to the blood plasma.

Inorganic elements of the plasma in dogs deprived of the hypophysis. P. MAZZOCCO. *Compt. rend. soc. biol.* 97, 594-5(1927); cf. *C. A.* 16, 1458.—The differences in the NaCl, P, Ca, Mg, K and Na contents of plasma in hypophysectomized dogs and controls were not significant.

Carbohydrate metabolism and the formation of ammonia in the blood. ALFRED GIGON. *Schweiz. med. Wochschr.* 57, 294-6(1927).—A relatively small dose of NH_4Cl in healthy rabbits produced a slight decrease of the blood C and N, an increase of the water, a hyperglucemia and acidification of the blood. There was a large increase in the ammoniacal N after NH_4Cl orally. After feeding $(\text{NH}_4)_2\text{CO}_3$ there was a decrease of the blood C and N, an increase of the sugar and ammoniacal N and a decrease of the blood p_{H} . Grape sugar injections increased the blood C and the blood N fell, accordingly decreasing the ammoniacal N. Glucose injections stopped the action of $(\text{NH}_4)_2\text{CO}_3$ and rapidly decreased the ammoniacal N. Urea given orally to both well rabbits and those with kidney disease increased the NH_3 in the blood. In the animals with renal disease the urea increased the blood C and N, the increase in ammoniacal N being much more evident than in normal animals. Sugar injections also stopped the action of urea.

R. C. WILLSON

G—PATHOLOGY

H. GIDEON WELLS

The effect of thyroid on calcium metabolism. C. W. HEATH, W. BAUER AND J. C. AUB. *Proc. Soc. Exptl. Biol. Med.* 23, 699-700(1926).—Patients with exophthalmic goiter and normal controls were given a diet deficient in Ca, 0.1 g. per day, but adequate in calories. Patients with a high basal metabolic rate had a very high Ca excretion; this decreased as the metabolism approached normal. One myxedema patient had a low Ca excretion; this increased when the basal metabolic rate was raised by thyroid and thyroxin. In all subjects the blood Ca and P were normal.

A study of parathyroidectomized rabbits. J. B. COLLIP. *Am. J. Physiol.* 76, 219(1926).—Since rabbits have been found to be relatively immune to the parathyroid hormone, a study of the blood chemistry of these animals has been made. Removal of parathyroids results in early tetany and death. Intravenous injection of the hormone will either delay tetany or, if it has already set in, will be followed by immediate relief. After removal of the glands there is a fall in blood Ca with no change in P. Injection of the hormone causes a maintenance of normal Ca. Massive doses of the hormone cause a blood Ca rise, but in normal rabbits this response is variable.

The occurrence of Liesegang's rings in serological precipitation. L. REINER AND H. KOPP. *Kolloid-Z.* 42, 335-8(1927).—Previous workers have explained the occurrence of double bands of ppt. when the soln. of antigen is placed over the antiserum on the assumption that the 2 bands are of different compn., one of them being the ppt. formed by the action of a protein and its antiserum and the other the ppt. of a lipid and its antiserum. It is now shown that the same double bands can be obtained even if the lipoids are first extd. from the reacting materials. Sometimes 3 or 4 bands are formed. Moreover double rings can be made with recrystd. egg albumin and an antiserum made by means of it. The double ring formation therefore has nothing to do with

the presence of lipoids or the pptn. of different chem. compds. but is merely a case of Liesegang's rings. F. L. BROWNE

The precipitin reaction of fibrinogen. LUDVIG HEKTOEN AND W. H. WELKER. *J. Infectious Diseases* 40, 706-12(1927).—The fibrinogens of beef, dog, horse, human, sheep and swine blood are precipitinogenic. These together with those of the goat, guinea pig, rabbit and rat have antigenic properties in common. Consequently, fibrinogen is not necessarily wholly different for each of these species, as seems to be the case with serum proteins and hemoglobin. While the mammalian fibrinogens just mentioned are not strictly species-specific, there appears to be also some relationship between them and chicken fibrinogen. This fact suggests that mammalian and bird fibrinogens are not wholly distinct and different. It seems probable that as it is possible to obtain precipitin serum that is practically specific for blood fibrinogen, the precipitin test may prove to be of value in efforts to trace the origin of fibrinogen and its relations to other substances. PAUL R. CANNON

The isolation, purification and chemical nature of immune hemolysins. SUSUMA UCHIDA. *J. Infectious Diseases* 40, 588-96(1927).—Extn. of sensitized sheep and human erythrocytes with a 10% soln. of saccharose and 5.6% soln. of dextrose leads to a slight degree of dissoen. The degree of dissoen. is influenced by the amt. and temp. of the dissoec. fluid, but not by the period of dissoen. nor by a weakly alk. dissoec. fluid. A nearly pure hemolysin was obtained by extg. with pure ether, dialyzing and salting out, indicating that the hemolysins are not lipoidal and are non-dialyzing colloids. PAUL R. CANNON

The isolation, purification and chemical nature of typhoid antibodies. SUSUMA UCHIDA. *J. Infectious Diseases* 40, 597-604(1927).—U. isolated anti-typhoid agglutinins and complement-fixing antibody from sensitized organisms by dissoen. with a 10% saccharose soln., the reaction occurring best at 60° for 20 to 30 min. Slight alkalization increased the degree of dissoen., whereas HCl reduced it. By means of a "salting out" method, dialysis and concn., solns. contg. the above antibodies were obtained free of sugar and salt but contg. about 4.8 to 8.4 mg. of total N per 100 cc. and a doubtful trace of protein. PAUL R. CANNON

Serum antilysins and methods for their removal. SUSUMA UCHIDA. *J. Infectious Diseases* 40, 605-9(1927).—Uric acid and cholesterol are more anticomplementary than urica, creatinine, creatine, glucose and bilirubin. Adsorption of anti-complementary serums with kaolin, blood charcoal, infusorial earth, BaSO₄ and corpuscles is of no practical value in relation to complement-fixation tests. Changes in the H-ion concn. of anticomplementary serums are without appreciable influence upon thermostable antilysins. PAUL R. CANNON

Removal of anticomplementary substances with hydrochloric acid (Sach's method). SUSUMA UCHIDA. *J. Infectious Diseases* 40, 610-14(1927).—The Sach's method of testing anticomplementary serums completely removed the thermostable antilysins from about 55% of the serums and reduced their amts. in the remaining 45%. Some of the Wassermann antibody was removed in all of the syphilitic serums tested. U. considers the method of practical value in Wassermann tests of slightly anticomplementary serums which contain large amts. of antibody. PAUL R. CANNON

Specific skin and testis reactions with culture filtrates of *Coccidioides immitis*. E. F. HIRSCH AND MARRIET BENSON. *J. Infectious Diseases* 40, 629-33(1927).—The growth of *Coccidioides immitis* in liquid media liberates a sol. sp. substance which in animals infected with *Coccidioides immitis* and in patients with coccidioidal granuloma causes skin reactions like those occurring with tuberculin in tuberculous animals. This sol. sp. substance is not destroyed by heating to 80° for 30 min. Prolonged electro-dialysis of the synthetic medium filtrate causes the sepn. of white floccules which dissolve readily in distd. water contg. a few drops of 0.01 N NaOH and the solns. cause skin reactions like the original filtrate. PAUL R. CANNON

The specific substance of *Coccidioides immitis*. E. F. HIRSCH AND DOROTHY D'ANDREA. *J. Infectious Diseases* 40, 634-7(1927).—From a synthetic protein-free culture filtrate of *Coccidioides immitis* a sp. substance contg. N and carbohydrate is recovered which in high diln. causes skin reactions in a patient with coccidioidal granuloma. The dried sp. substance is a white powder readily sol. in H₂O, 0.9% NaCl soln., dil. alkalies and acids, contains about 3-4% N, and on dialysis, 20-40% reducing sugar measured as dextrose. The osazone soln. resembles in structure the dextrosazone. PAUL R. CANNON

The preparation and precipitin reactions of egg albumin and blood proteins of the domestic fowl. LUDVIG HEKTOEN AND A. G. COLE. *J. Infectious Diseases* 40, 647-55(1927).—According to the precipitin reaction, albumin can be sepd. from the

other principal proteins of chicken blood plasms by $(\text{NH}_4)_2\text{SO}_4$ pptn. and dialysis, but this method seems incapable of bringing about a complete sepn. of euglobulin and pseudoglobulin. It is also difficult, if not impossible, completely to sep. fibrinogen from euglobulin by this method. There is a definite immunological relationship between the albumins of egg white and of chicken blood and the albumin of egg white may be resolved into several fractions which differ widely in their reactions with precipitin serum for blood albumin.

PAUL R. CANNON

The relationship between the intracellular globulin and the toxin of *Cl. botulinum*. C. I. NELSON. *J. Infectious Diseases* 41, 9-12(1927).—N. concludes that the toxin of *Cl. botulinum* is elaborated within the cell in intimate assocn. with the characteristic bacterial globulin; its appearance in the surrounding medium is assocd. with the globulin with which it is still bound, and is accompanied by cell mortality or disintegration, so that in this sense the toxin is not in itself a true secretion; and the toxin is evidently not identical with the intracellular globulin since it can be freed of the assocd. globulin by peptic digestion.

PAUL R. CANNON

Fat metabolism of the lung with consideration of the pneumothorax lung. R. H. BERG. *Beitr. klin. Tuberk.* 64, 718-25(1926).—The differences in the morphologic appearances of intravenously and intratracheally injected cod-liver oil as well as fed oil were studied in the normal and pneumothorax collapsed rabbit's lung. There was found histologic evidence of a more rapid disappearance of the fat from the pneumothorax lung as compared to the normal lung.

H. J. CORPER

The prognostic value of the urochromogen reaction, blood sedimentation rate and blood picture for the sanatorium. BECKER. *Beitr. klin. Tuberk.* 64, 726-33(1926).—The positive urochromogen test as an index of increased protein destruction occurs only in the final stages of tuberculosis, with a possible exception of individual cases of transient perifocal inflammation. The use of K persulfate in place of the highly colored KMnO_4 as a test reagent is advised. In addn., the blood sedimentation quotient and white blood picture are recommended as prognostic aids. The Wahl-Schömborg quotient $--a/(b-a)$ (a being the one-hr. and b the 2-hr. value) when above 1 is favorable and below unfavorable prognostically. In detg. the white blood picture the monocytes must also be considered according to Junker, a diminution below 5% being unfavorable.

H. J. CORPER

The use of the Costa reaction for the activity diagnosis of pulmonary tuberculosis. E. LADBECK. *Beitr. klin. Tuberk.* 64, 766-8(1926).—The Costa flocculation reaction can be used as a substitute for the sedimentation reaction in the absence of sufficient blood or lack of a suitable vein. 1.5 cc. of a 2% novocaine soln. in physiol. NaCl is placed in a centrifuge tube and 3 drops of 5% Na citrate added; 3 drops of blood from the finger is allowed to fall into the mixt. which is centrifuged or allowed to stand 12 hrs. until the corpuscles have completely settled out; 1 drop of pure HCOH soln. is then dropped into the fluid and the no. of minutes are noted when the first flocculation occurs in the clear fluid. After 15 min. the reaction may be positive in healthy individuals. The test is positive only when the sedimentation figures are markedly increased. It parallels the sensitiveness of the sedimentation reaction.

H. J. CORPER

Adrenaline blood pressure curves and serum calcium mirror at high altitude. MAX DUGGE. *Beitr. klin. Tuberk.* 65, 96-111(1926).—The adrenaline blood pressure curve is only of value in so far as the part played by the vegetative nervous system upon the circulatory organs is concerned in explaining the climatic action of high altitudes. The results of other tests of the vegetative nervous system are frequently contradictory. The adrenaline curve alone will not permit an exclusive conclusion concerning sympathetic insufficiency since there are cases in which psychogenic irritation can occasion blood pressure and pulse changes, while adrenaline does not act thus. A definite relation between the abs. serum Ca content, and the course of the adrenaline reaction does not exist. A definite adrenaline blood pressure curve occurring within a 2 months' residence at high altitude was not noted, yet in individual cases with low serum Ca content and good reacting power of the vegetative nervous system an increase in the serum Ca occurred. No correlation between the grade of serum Ca increase and the form of tuberculosis existed.

H. J. CORPER

Pock detritus as a protein substance. M. RAKUZIN AND T. GENKE. *J. exper. Biol. Med.* (Russ.), No. 4, 57-64; *Chem. Zentr.* 1926, II, 605.—Glycerol-free pock detritus gives biuret, Millon, xanthoprotein, Adamkewitsch, Ostromuisslenski and Molisch reactions, and yields to 95% EtOH substances which give the Moli ch and the Adamkewitsch reactions. When adsorbed by $\text{Al}(\text{OH})_3$, the aq. soln. of the detritus first loses its positive biuret reaction and then loses its Millon reaction.

C. C. DAVIS

The effect of pregnancy and lactation on the blood calcium of thyroparathyroidect-

tomized dogs. E. LARSON AND N. F. FISHER. *Endocrinology* 11, 233-6(1927).—In 2 cases it was found that the blood Ca of thyroidectomized and partially parathyroid-ectomized dogs was decreased by pregnancy and lactation. These dogs had maintained a normal Ca level previous to pregnancy. H. J. DEUEL, JR.

Case of Bence-Jones proteinuria, with a note on the urinary excretion of mineral elements. R. A. CURRIE. *Glasgow Med. J.* 107, 31-4(1927).—A report of a case in which an increased urinary excretion of Ca and of Mg were noted. This suggests rapid bone destruction which is in line with the frequent assocn. of Bence-Jones proteinuria with myeloma. H. J. DEUEL, JR.

Gastric analysis in cases of diabetes and glucosuria. EVELYN MCPHERSON. *Glasgow Med. J.* 107, 340-50(1927).—Hypochlorhydria is often assocd. with diabetes. H. J. DEUEL, JR.

Variation in the reactions obtained in repeated agglutination tests of the same fowls with *Bacterium pullorum* antigen. J. R. BEACH. *Hilgardia* 2, 529-44(1927).—A positive reaction to the agglutination test may be considered a highly accurate indication of *Bact. pullorum* infection. A negative reaction to a test, however, appears less accurately to indicate freedom from this infection either recently acquired or of long standing. CARL R. FELLERS

The elimination of cloudy reactions by the use of formalin as a preservative for *Bacterium pullorum* antigen. J. R. BEACH AND S. TER-MICHAELIAN. *Hilgardia* 2, 545-53(1927).—Formolized antigen (0.1%) was much more satisfactory than phenolized antigen in preventing cloudiness in 1700 tests. CARL R. FELLERS

The clinical value of the determination of the urea and indican contents of blood serum. MICH. SZOUR. *Deut. med. Wochschr.* 53, 964(1927); cf. *C. A.* 21, 1302.—The Haas and Rosenberg modification of Jolle's method for the detn. of indican is of clinical value. ARTHUR GROLLMAN

State of combination of calcium in the serum. The pathological significance of this state of combination. KARL KLINKE. *Klin. Wochschr.* 6, 791-4(1927).—Ca appears in blood serum in 3 forms: (1) An ionized portion which amounts to about 2 mg.%. (2) A complex or molecular aggregate that is sol. (3) A complex aggregate that is combined with the protein, possibly by adsorption. The serum is never satd. with the Ca ion. The theoretical satn. concn. of the Ca ion is 3 mg.%. MILTON HANKE

Comparative studies on the blood sugar content of arterial and venous blood in normals and in diabetics. G. ROSENOW. *Klin. Wochschr.* 6, 805-6(1927).—The blood sugar content of arterial and of venous blood is identical in diabetics. Arterial blood normally contains more sugar than does venous blood. MILTON HANKE

Serological studies concerning the influence of normal serums on isolated vascular preparation. E. FRIEDBERGER. *Klin. Wochschr.* 6, 1047(1927).—The lower half of the body of rats and guinea pigs was perfused with serums, in various dilns., in such a manner that the drops of liquid coming from the vein could be counted as in the Lawen-Trendelenberg prepn. The animal's own serum, active or inactivated, produces a max. contraction of the vascular system. This poisonous effect can be eliminated by washing out the prepn. with Ringer soln. The action of the serum is entirely reversible. The toxicity of foreign serums in this prepn. parallels their toxicity in the intact animal. Inactivated foreign serum is less toxic than the active serum. Kaolin and tissue cells absorb the toxic substance. Concns. of foreign serums that are too small to contract the blood vessels produce a dilation. Plasma is usually not toxic, a notable exception being eel plasma which is highly toxic even in minute concns. Serum globulin is not toxic. MILTON HANKE

Hypersensitiveness of isolated blood vessel preparations from sensitized and injected animals. E. FRIEDBERGER. *Klin. Wochschr.* 6, 1095-6(1927); cf. preceding abstract.—Isolated blood vessel prepn. from sensitized animals react with dilns. of the homologous serum that is many hundred times below that of the normal reaction range. The contraction of the vessels is instantaneous. The anaphylactic reaction is specific even for a definite fraction of the serum. The contraction continues as long as the serum is perfused through the vessels. The vessels of the sensitized animals are also more reactive to normal serum. The reaction comes on instantaneously; but the vessel tonus decreases as the perfusion continues. An anaphylactic contraction of the vessels is not obtained if the perfusion with homologous serum is conducted after the prepn. has been carefully washed out with Ringer soln. This proves that the hypersensitiveness is not due to something associated with the cells. MILTON HANKE

Potassium and calcium content of whole blood in edema in animals. FRANZ KISCH. *Klin. Wochschr.* 6, 1085-6(1927).—Edema was artificially produced in the

hind legs of animals. The K content of the whole blood in the edematous parts is markedly increased; the Ca content remains unchanged. MILTON HANKE

Glucose equivalent of insulin in diabetes mellitus of children. RICHARD PRIESEL AND RICHARD WAGNER. *Klin. Wochschr.* 6, 1225-7(1927).—The glucose equiv. of insulin in diabetic children depends upon the age of the child, duration of the disease and the body wt. MILTON HANKE

Carbohydrate metabolism of tumors. C. FAHRIG* AND L. WACKER. *Klin. Wochschr.* 6, 1227-8(1927).—Lactic acid production by surviving tissue was studied by the method of Warburg. All of the tissues investigated (myoma, sarcoma, carcinoma, uterus muscle, fascia, epidermis and striated muscle) produce lactic acid when O is present. Normal striated muscle produces more lactic acid than any of the other tissues. All of the tissues, excepting the striated muscle, produce more lactic acid when O is absent. MILTON HANKE

The mechanism of protein therapy. STEFAN RUSZNYÁK AND ANDREAS KORÁNYI. *Klin. Wochschr.* 6, 1332-3(1927).—Animals sensitized to horse serum usually react with fever when they are reinjected with 1 mg. of horse serum. A subsequent injection of 2.5 mg. S again leads to a rise in temp. Novoprotein (0.5 cc.) does not produce fever. In either case a reaction is not obtained upon the reinjection of horse serum. The S and the heterogeneous protein have desensitized the organism so that it is incapable of reacting with the original irritating substance. Injection of a heterogeneous protein may, in a few animals, lead to a fall in temp. and a state of collapse. Such animals are not desensitized; for a subsequent injection of the homologous protein leads again to a rise in body temp. MILTON HANKE

The new modification of the Emanuel mastic reaction as applied to cerebrospinal fluid. G. EMANUEL AND H. ROSENFELD. *Klin. Wochschr.* 6, 1375-8(1927).—The method is described in detail. Good bibliography. MILTON HANKE

Control of the acid-base balance in secretion disturbances of the stomach. LEO HERMANN AND J. M. SAKK. *Klin. Wochschr.* 6, 1367-70(1927).—The alkali reserve varies normally from 53 to 60. Hyperacidity is associated with fasting values that hover around 53. A test meal which elicits an abnormal flow of HCl leads to a marked temporary increase in the alkali reserve value. Isochlorhydria is characterized by a high, fasting alkali reserve value—about 60—and by the fact that the ingestion of food either does not increase this value, or lowers it. The alkali reserve of the blood is influenced by the secretion of HCl into the stomach and by the excretion of alkali into the intestine. The latter factor is, normally, of little consequence because it is so markedly overbalanced by the HCl secretion. Secretion of alkali into the intestine does, however, influence the alkali reserve in cases of isochlorhydria or achylia because in these cases there is little or no secretion of HCl. MILTON HANKE

The nature of allergens. F. KLEWITZ AND R. WIGAND. *Klin. Wochschr.* 6, 1432-3(1927).—Allergens are heat-resistant and not heat-coagulable, not pptd. by cold, satd. $(\text{NH}_4)_2\text{SO}_4$ pptd. by $(\text{NH}_4)_2\text{SO}_4$ in substance, dialyzable, adsorbed irreversibly and quant. by animal charcoal, adsorbed to some extent by kaolin and by $\text{Al}(\text{OH})_3$, sol. in 85% NaCl, insol. in EtOH, Et₂O, CHCl_3 and Me_2CO , and do not give a biuret reaction. MILTON HANKE

Lactic acid content of blood particularly in hepatopathics. G. NOAH. *Klin. Wochschr.* 6, 1465-6(1927).—The lactic acid content of the blood is normal in hepatopathics excepting in very severe cases; in these it is elevated. Venous blood from a large malignant tumor contains more lactic acid than blood from any other part of the body. MILTON HANKE

Rickets. ARNOLD ORGLER. *Klin. Wochschr.* 6, 1501-5(1927).—A review. No bibliography. MILTON HANKE

Influence of the environment temperature on immunity and infection. E. FRIEDBERGER AND S. SEIDENBERG. *Klin. Wochschr.* 6, 1515 6(1927).—Guinea pigs were injected with sheep serum. Some of the animals were kept in warm lab. cages; a second group was placed in similar cages but outdoors (temp. 6°). The food, body temp. and gain in wt. in both groups were the same. After 17 days the animals that were kept warm were hypersensitive to 0.01 cc. of sheep serum. The animals kept in the cold were not sensitive to sheep serum regardless of the dose used. Hypersensitivity does not develop in the latter animals if they are transferred to a warm room for 1 to 2 weeks before reinjection. The elevated metabolism that is necessary to keep the animals warm at low surrounding temps. must lead to a destruction of the antigen in such a way that the body cells do not become sensitive to it. MILTON HANKE

Colloid chemical model of the double-ring phenomenon. R. DOERR AND E. BERGER. *Klin. Wochschr.* 6, 1562-3(1927).—The double-ring phenomenon that is

observable when an antigen soln. is superimposed upon an immune serum soln. can be duplicated by superimposing a 1% soln. of thorium sulfate upon a dil. soln. of normal horse serum or by superimposing the thorium sulfate soln. on a 2% Na_2CO_3 soln. The double ring occurs always in the upper liquid. This can be proved by mixing gelatin with an immune serum and superimposing the antigen on the solid mass. The rings occur in the liquid phase. An explanation is to be given elsewhere. MILTON HANKE

Zone phenomena, double-ring phenomena and their origin. L. REINER AND H. KOPP. *Klin. Wochschr.* 6, 1563(1927).—Friedberger asserts that the two rings formed, when an antigen is superimposed upon an immune serum, are of different compositions, the upper one being lipid in character (cf. *C. A.* 20, 235). That this is not the true explanation is proved by the fact that the double-ring phenomenon is exhibited by substances that are both chemically and immunobiologically pure. The zone phenomenon is a physical manifestation. The clear band between the two ppt. rings represents an area in which concns. of antigen and antibody exist that are favorable to the resolution of the ppt. Theoretically it should be possible to have more than two rings and this can, indeed be accomplished, under suitable exptl. conditions, which are described.

MILTON HANKE

Blood-chemistry studies in leprosy. II. The alkali reserve. E. M. PARAS. *Philippine J. Sci.* 33, 155-67(1927); cf. *C. A.* 20, 3504.—The Van Slyke detn. of CO_2 capacity was performed on 12 specimens of blood plasma from healthy subjects and 110 cases of leprosy. The readings obtained for normal non-lepers range from 60 to 78 vol. %. This variation is about the same as that found by other investigators for normal individuals. Uncomplicated leprosy is not accompanied by any significant change in the alkali reserve. The av. readings showed: (a) In lepra reaction most cases gave normal results; possibly reduction of alkali reserve occurs only in a severe febrile reaction. (b) Characteristic readings of alkalosis were observed in some of the cases with lepra reaction who received alkali treatment. (c) Significant reduction of the alkali reserve was observed in lepers with nephritis and in those with miscellaneous complications. (d) Practically normal results were noted for lepers with tuberculosis. Detn. of alkali reserve in connection with alkali therapy is evidently important in lepra reaction, and is valuable in the study of nephritis among lepers. No correlation can be traced between the alkali reserve and the duration, type and advancement of the leprosy or the antileprosy treatment.

A. L. HENNE

Bacterial invasion of the enamel in dental caries. C. F. BÖDECKER. *Dental Cosmos* 69, 987-1002(1927).—Caries of the enamel is not a simple soln. of the inorg. salts. The active agents are bacteria which penetrate through the body of the enamel rod proper. The acid which is formed penetrates the enamel deeply in all directions.

JOSEPH S. HEPBURN

Basal metabolism in anemias. LEOPOLDO ROSSI. *Arch. patol. clin. med.* 5, 583-91(1927); *Ber. ges. Physiol. exptl. Pharmacol.* 41, 65-6.—No relation was found between basal metabolism and hemoglobin content. In 2 cases of aplastic anemia the basal metabolism was -8.6 to -39.47 and -10.5 to -17.7%. In tuberculous anemia it was increased by 25 to 42.3%, and varied between -13 and 7.5 in secondary hemorrhagic anemia. In pernicious anemia with splenomegaly it was 37 to 46 before splenectomy, and fell to 12.4 to 13.5, -5 to -6 and finally 1 within 2.5 weeks after the operation. The metabolic values above and below normal probably correspond with increased and decreased activities of the hematopoietic system.

MARY JACOBSEN

Toxic effect of tumors and organs of the chicken. A. H. ROFFO AND R. LÓPEZ RAMÍREZ. *Bol. inst. med. exp.* 2, 877-82(1926); *Ber. ges. Physiol. exptl. Pharmacol.* 41, 34.—The blood pressure of dogs is not materially altered by the injection of an ext. of Rous tumor or of the liver of a normal chicken or of one having a Rous tumor, provided the ext. is filtered or heated to 55° with or without centrifuging. The centrifuged ext. of a chicken tumor causes in chickens severe hypotension and death with convulsions. Lung. ext. (of a tumor chicken?) acts similarly. The effect is suppressed by ultrafiltration or heating. Injections of the virus extd. from a chicken sarcoma has no effect on either blood pressure or survival of chickens.

MARY JACOBSEN

The toxicity of tumors in relation to the organs on which they develop. A. H. ROFFO AND E. GARCIA VELLOSO. *Bol. inst. med. exp.* 2, 973-7(1926); *Ber. ges. Physiol. exptl. Pharmacol.* 41, 34-5.—The ext. of lung metastases is more toxic than that of the original tumor. The toxicity of lung ext. is higher than that of liver ext. Whenever there is a consistently higher relative toxicity of both tumor and substrate tissue, the former may be considered as detd. by the substrate rather than by the neoplastic tissue itself.

MARY JACOBSEN

The presence of an insulin-like substance in malignant tumors. A. H. ROFFO

AND L. M. CORREA. *Bol. inst. med. exp.* 2, 969-71(1926); *Ber. ges. Physiol. exptl. Pharmacol.* 41, 34; cf. *C. A.* 21, 2732.—The question is discussed whether the insulinoid of the rat tumor is a reserve substance or a sp. product of the tumor. The occurrence of insulinoids in almost all organs of various animals is in favor of the former, their presence in plants in favor of the latter view.

MARY JACOBSEN

Effect of thyroid on purine metabolism. I. Effect of thyroid feeding and thyroidectomy on the purine metabolism of the dog. R. WAKABAYASHI. *Folia endocrinol. japon.* 2, 17-9, 415-50(1926); *Ber. ges. Physiol. exptl. Pharmacol.* 41, 60.—In a normal bitch thyroid feeding caused after a certain period of time a distinct and progressive rise of total N and an abs. and relative increase of allantoin, uric acid and purine bases. The values gradually returned to normal after thyroid feeding was discontinued. Thyroidectomy had the opposite effect. It was most pronounced after removal of $1/2$ the thyroid. The wt. was unchanged or slightly increased. **II. Purine metabolism of man in disturbances of thyroid function.** *Folia endocrinol. japon.* 2, 20-1, 478-511 (1926); *Ber. ges. Physiol. exptl. Pharmacol.* 41, 60.—The normal Japanese excretes daily 0.208 g. uric acid N (I) and 0.0174 purine bases N (II), i. e., 1.37 and 0.20% of the total N (III), resp. Hyperthyroidism, especially Grave's disease, is assocd. with an increase in I, II and III. In hypothyroidism II and III are lowered, while I remains normal; all 3 increase on thyroid medication. The ratio I/III remains unchanged, while II/III is slightly increased.

MARY JACOBSEN

The calcium content of human blood and its regulation by the endocrine glands under normal and pathological conditions. CARLOS P. WALDORF. *Prensa med. argentina* 12, 1216-25(1926); *Ber. ges. Physiol. exptl. Pharmacol.* 40, 694-5.—In 26 cases of thyroid disease an increase of basal metabolism was assocd. with hypocalcemia; there was, however, no direct proportionality. Both returned to normal under irradiation or after thyroidectomy. Serum therapy was ineffective. W. agrees with Leicher that unlike I thyreoidin lowers the blood Ca in normal man. **II.** *Ibid* 13, 67-73.—In 4 cases of acromegaly the basal metabolism was distinctly above normal. X-ray therapy lowered the basal metabolism and blood Ca, the latter reaching the values: 7.6, 7.9, 8.5 and 10.26. The hypocalcemia is made responsible for the pronounced hyperexcitability of the vagus. **III.** *Ibid* 13, 102-6.—A discussion chiefly based on literature data of the effect of ovariectomy, menstrual cycle, ovarian feeding and normal and pathol. pregnancy on the blood Ca. **IV.** *Ibid* 140-3.—In man with testicular insufficiency the blood Ca is related to the basal metabolism. Parathyroidectomy in animals is followed by hypocalcemia. Administration of Ca relieves hypocalcemia and tetany. Parathyroid ext. raises the blood Ca only to its normal level. Human tetany is assocd. with frank or latent hypocalcemia.

MARY JACOBSEN

Muscle carbohydrate in adrenalectomized dogs. G. VIALE, SIMON M. NEUSCHLOSZ AND ESTEBAN TURCATTI. *Rev. méd. Rosario* 17, 24-6(1927); *Ber. ges. Physiol. exptl. Pharmacol.* 40, 810.—The muscle glycogen of adrenalectomized dogs is below normal, but never disappears completely. The lactacidogen content shows a decrease of 50% which is attributed to a modification of muscle function or inactivation of an enzyme rather than to carbohydrate deficiency. An analogy between adrenalectomy and insulin poisoning is denied, since serum of adrenalectomized dogs does not cause hypoglycemia and because Audowa and Wagner observed an increase in lactacidogen under large doses of insulin.

MARY JACOBSEN

Chronic tetany. H. J. JOHN. *Ann. Surgery* 85, 410-27(1927).—Parathyroidectomy is due to a disturbance of the mechanism which governs the metabolism of Ca. Parathyroid hormone supplies the essential element for the operation of this mechanism. It causes an alleviation of symptoms and a rise in the Ca. The serum Ca in chronic cases of tetany is not less than 8 mg. per 100 cc., whereas in acute tetany the lowest figure was 4.5 mg.

FRANCES KRASNOW

Post-operative water metabolism and intradermal salt solution test. A preliminary report. K. E. APPEL AND SELLING BRILL. *Ann. Surgery* 85, 502-8(1927).—There is frequently a reduced disappearance time of the intradermal salt soln. in wheal, after operation. This test may be used as a method for detg. the need of the tissues for water.

FRANCES KRASNOW

Behavior of the blood sugar and liver glycogen in rats infected with trypanosomes. P. REGENDANZ AND C. TROFF. *Arch. Schiffs-Tropen Hyg.* 31, 376-85(1927).—The blood sugar is greatly lowered before death. The decrease is not due to the consumption of the sugar by the parasite but to the effect of its toxin on the sugar-producing organs. The same lowering also occurs in the liver glycogen.

FRANCES KRASNOW

Behavior of serum bilirubin in malaria. M. SCHACHSUWALY. *Arch. Schiffs-*

Tropen Hyg. 31, 399-413(1927).—Serum bilirubin is increased in acute malaria but remains normal in latent cases or in cases without fever. FRANCES KRASNOW

The chemistry of the malaria pigment. W. WARAS. *Arch. Schiffs-Tropen Hyg.* 31, 428-31(1927).—The pigment is sol. in ether, acetic acid and alkali. Its empirical formula is $C_{24}H_{182}N_{22}FeO_{82}$. It resembles Fe-contg. melanin. FRANCES KRASNOW

Blood gas-content in certain pathological conditions of gastric secretion. H. S. LURJE. *Arch. Verdauungskrankh.* 41, 30-9(1927).—During hyperacidity the CO_2 content of the blood has either a high normal value or is a little above normal. In hypoacidity a decrease in the CO_2 content is indicated. There seems to be no parallelism between the O_2 content of the blood and the gastric acidity. FRANCES KRASNOW

Determination of the secretion-activity of the liver by chromoscopy. N. W. KUZNETZOV, L. I. KUZNETZOV AND V. N. SUCHOV. *Arch. Verdauungskrankh.* 41, 89-97(1927).—When the liver secretion is normal, indigo carmine is excreted 15 to 45 min. after injection and lasts usually 1.5 to 2 hrs. In catarrhal conditions excretion occurs between 12 min. and 1 hr. and 50 min. The total excretion is between 4 and 13% as compared with the normal 42 to 74%. The same decrease in total excretion and delay in excretion takes place in other liver affections. FRANCES KRASNOW

A rapid method for the diagnosis of plague. F. M. MARRAS. *Indian J. Med. Research* 14, 287-9(1926).—There are prepd. 2 test tubes contg. 2-3 cc. of glucose soln. and 2 test tubes contg. sucrose soln. One drop of agglutinating antiplague serum of a rabbit (dilu. 1 in 80 to 1 in 100) is then added to one of the 2 tubes of glucose and one drop to one of the tubes of sucrose soln. To each of the 4 tubes is added 1 drop of the material to be examd. In the solns. of sugar with homologous specific antiserum, the multiplication of the plague bacilli takes place rapidly within 5 to 7 hrs. At the same time clots and flakes appear which little by little ppt. and the solns. become acid. FRANCES KRASNOW

Epidemic dropsy: its blood picture, general and biochemical. CHARUBRATA RAY. *Indian J. Med. Research* 15, 67-79(1927).—The total N ranged between 1.4 and 2.52 g. per 100 cc. of whole blood, the non-protein N, between 22.4 and 42 mg. per 100 cc. of whole blood, urea between 18 and 30 mg., creatinine between 1.2 and 1.4 mg., uric acid between 2.8 and 5.0 mg., glucose between 95 and 135 mg., chlorides between 490 and 677 mg., calcium between 6.1 and 15 mg. and cholesterol between 89 and 185 mg. per 100 cc. of whole blood. FRANCES KRASNOW

Some observations on cases of anemia among troops in Bombay. P. N. BASU. *Indian J. Med. Research* 15, 107-16(1927).—There is a marked deficiency in free HCl in the gastric juice; the ratio of neutral fat to free fatty acids in the feces is 1:2.9 for the normal and becomes as high as 1:8.8 in the diseases. There is a slight diminution in the blood lipoids. FRANCES KRASNOW

The relation of endemic goiter to the iodine content of soil and drinking water. R. MCCARRISON, C. NEWCOMB, B. VISWANATH AND R. V. NORRIS. *Indian J. Med. Research* 15, 207-46(1927).—Richness of the soil in I does not preclude the presence of thyroid swelling in 27.7% of girls and 11.8% of boys living at an altitude of 6000 ft. and in a place where endemic goiter is conspicuous by its absence in the general population. The investigation has provided no evidence that in Himalayan India the incidence of endemic goiter is in inverse ratio to the I content of the soil. The water supply may contain an appreciable amount of I and yet goiter be endemic. The substitution of a bacteriologically pure for a bacteriologically impure water has caused rapid disappearance of the endemic, although the new water supply contained less I than the old. I-contg. salts or substitutes for the salts appear to have an influence on preventing this type of endemic goiter. FRANCES KRASNOW

The effect of adsorbents upon the potency of tuberculin. M. DORSET, R. R. HENLEY AND H. E. MOSKEY. *J. Am. Vet. Med. Assoc.* 70, 373-7(1927).—The potency of tuberculin produced from synthetic medium is greatly lowered when passed through filters of diatomaceous earth. The active constituents are adsorbed by substances having a negative charge. FRANCES KRASNOW

Trypanosomiasis of camels in the Anglo-Egyptian Sudan: Diagnosis, chemotherapy, immunity. R. H. KNOWLES. *J. Comp. Path. Therap.* 40, 118-43(1927); cf. *C. A.* 21, 3080.—The formol-gel test, although subject to small errors, is a useful, practical method of diagnosis of trypanosomiasis of camels. Naganol employed in a dose of 10 g., in 10% soln. in water and administered intravenously is a specific in the treatment of camels affected with trypanosomiasis due to *T. soudanense*. Treatment of the disease by combining small doses of Naganol and tartar emetic has given good results with considerable saving in cost. FRANCES KRASNOW

The passage of antigens and antibodies through the placenta. L. NATTAN-LARRIER.

G. RAMON AND E. GRASSET. *Ann. inst. Pasteur* 41, 862-7(1927); cf. *C. A.* 21, 1488.—Toxins and anatoxins when used in doses comparable to those occurring under natural conditions do not pass the placenta in exptl. animals. When abnormally high doses of tetanus toxin are used in the guinea pig, a small quantity passes the placenta and affects the fetus. Diphtheria and tetanus antitoxins, on the other hand, pass the placenta readily. Thus passive immunity may be transmitted from mother to offspring.

E. R. LONG

The passage of toxins, anatoxins and antitoxins through the wall of the alimentary canal. Active and passive antitoxic immunity via the alimentary canal in experimental animals. G. RAMON AND E. GRASSET. *Ann. inst. Pasteur* 41, 868-78(1927).—Young animals after ingestion of moderate doses of diphtheria and tetanus anatoxin, and adult animals after ingestion of massive doses of either toxin or anatoxin, acquire a sp. antitoxic immunity. This is a general humoral immunity, appearing in the same manner as that developing after subcutaneous injection, but of higher degree. Passive immunity is likewise conferred by ingestion of antitoxin, preferably in bile dild. with serum, and is also more effective than that developing after subcutaneous injection. E. R. L.

Glucolysis in leucemic blood. H. I. SCHMITZ AND E. C. GLOVER. *J. Biol. Chem.* 74, 761-73(1927).—The rate of glucolysis in blood from 10 normal individuals varied between 15 and 23 mg. per 100 cc. per hr. and an initial concn. of from 60 to 250 mg. per 100 cc. did not affect the rate in normal or leucemic blood. In chronic myelogenous leucemia the rate may be as rapid as 84 mg. per 100 cc. per hr. and tends to run parallel with the no. and immaturity of the white blood cells. In chronic lymphatic leucemia the rate is seldom more rapid than normal except when the lymphocytes are very immature. A marked increase in the rate of glucolysis in myelogenous leucemia is caused by 0.001 N KCN; there is a less definite increase in lymphatic leucemia. KCN has very little effect on the rate in normal blood. Cf. Falcon-Lesses, *C. A.* 21, 2027.

A. P. LOTHROP

The correlation coefficients of the urine with special reference to cancer. C. P. WHITE. *J. Path. Bact.* 28, 211-31(1925).—Urea is correlated chiefly with creatinine, phosphoric acid, and K; creatinine with K, Na, chloride and water; uric acid with phosphate and acidity, and in cancer cases with Ca; sulfate with Mg and K; phosphate with K, Ca and Mg; chloride with Na and K. The chief alk. phosphates are those of Na and Ca, and the chief acid phosphates those of K, Ca and Mg. NH_3 is correlated in cancer cases with strong acids and acidity, and in non-cancer cases with weak acids and alk. Neutral S is correlated in cancer cases with undetd. N, and in non-cancer cases with creatinine, chloride and Na.

JOHN T. MYERS

Non-typical Wassermanns in spinal fluids. MABEL M. MALCOLM. *Public Health J.* 18, 115-7(1927).—Details are given of 8 specimens of spinal fluid which were found to give a positive reaction with an acetone-insol. antigen and a negative reaction with cholesterinized antigen. Such atypical reactions were never obtained with blood serum although many more tests were made than with spinal fluid, the same reagents being employed in each case.

R. E. THOMPSON

Obesity and thinness. Studies on the specific dynamic action in them of protein. F. H. MASON. *Northwest Med.* 26, 143-6(1927).—In 10 cases of the so-called simple obesity the specific dynamic action of protein was decreased. In hypophyseal obesity (5 cases) there was very little specific dynamic action for protein. In 1 case of "constitutional thinness" there was an increased specific dynamic action for protein.

R. C. WILLSON

The distribution of water and cholesterol in the blood in experimental anemia. MEYER BODANSKY AND O. G. DRESSLER. *Quart. J. Exptl. Physiol.* 17, 157-60(1927).—In exptl. anemia produced by phenylhydrazine and acetylphenylhydrazine, the vol. of the av. red corpuscle is increased. This change is associated with a disproportionate increase in the water content of the corpuscle. However, the swelling is accompanied by an increase rather than a decrease in the cholesterol content of the corpuscle.

FRANCES KRASNOW

An improved antigen for the agglutination test in bacillary white diarrhea. W. L. MALLMANN. *J. Am. Vet. Med. Assoc.* 71, 600-6(1927).—A *B. pullorum* antigen contg. 1 cc. N NaOH to 100 cc. of antigen is recommended. This antigen is somewhat more sensitive, eliminates cloudy reactions and does not require birds to be starved for 48 hrs. previous to bleeding.

FRANCES KRASNOW

The recovery process after fatigue of mammalian skeletal muscle in the normal and the diabetic animal. T. H. MILROY. *Quart. J. Exptl. Physiol.* 17, 161-77(1927).—The characteristic changes in fatigue are entrance of water, loss of some phosphate, depletion of the glycogen store, low lactacidogen value and, for stimulated muscle, low

lactic acid percentage. The less fatigued or the more excitable the muscle, the less the loss in glycogen, the higher the lactic acid value, the better the esterification under fluoride and the smaller the increase in the water content. The recovery process is characterized by a reversal of the fatigue changes. In the depancreatized animal the disturbance in glycogen depends on the severity of the diabetic condition. "Recovery" in the diabetic shows practically no improvement in the glycogen storage and only an insignificant increase in esterification.

FRANCES KRASNOW

The amount of blood phenolase in different dermatoses. M. MELCZER. *Dermatol. Wochschr.* **84**, 317-21 (1927).—While the phenolase titer of the serum in a large group of dermatoses was found to be normal when using a method which was perhaps not sufficiently sensitive, in sp. infections, as lupus vulgaris and particularly in cases of syphilis showing decided symptoms, the phenolase titer was markedly decreased. R. C. W.

II—PHARMACOLOGY

A. N. RICHARDS

The influence of insulin on the tolerance for intravenously injected glucose and fructose. G. T. CORI AND C. F. CORI. *Proc. Soc. Exptl. Biol. Med.* **23**, 461-3 (1926).—The intravenous tolerance of male rats after a 48-hr. fast was approx. 2.5 g. of glucose per kg. per hr.; large doses of insulin raised the tolerance to 3.0 g. The tolerance for fructose when infused into the femoral vein was approx. 0.35 g., and 0.6 to 0.8 g. when infused into a mesenteric vein. Insulin had no effect on the intravenous tolerance for fructose. C. V. B.

Electrocardiographic studies of the action of propylene and some other anesthetic gases. A. M. CAINE AND C. REYNOLDS. *Proc. Soc. Exptl. Biol. Med.* **23**, 488 (1926).—Propylene in concns. of 25 to 50% caused ectopic (originating at various points in each ventricle) beats in the dog and cat. Ectopic beats promptly ceased when the concn. was lowered. This phenomenon did not occur with ether, chloroform, N₂O, ethylene, or acetylene. C. V. B.

The fate of xylose in the animal body. R. C. CORLEY. *Proc. Soc. Exptl. Biol. Med.* **23**, 491-2 (1926).—The fermentable and non-fermentable reducing substances in rabbit blood were detd. before and at hourly intervals following the intravenous injection of 1 g. of xylose; the results were expressed as glucose by the Shaffer-Hartmann method. In general the total blood sugar paralleled the unfermented fraction. Following xylose the reducing power of the blood after fermentation returned to normal in 4 hrs. in controls, in 2 hrs. in phlorhizin diabetes, in 4 hrs. in chloroform poisoning, and had not reached normal in 8 hrs. in tartrate nephritis. The injection of glucose caused no change in the unfermentable sugar. C. V. B.

The effect of insulin on the rate of disappearance of reducing substances in toad blood at different temperatures after injection of glucose. J. M. D. OLMSTEAD. *Am. J. Physiol.* **76**, 200 (1926).—Toads injected with insulin show convulsions in about 36 hrs. at 18°, 24 hrs. at 25° and 18 hrs. at 30°. At 18° the reducing power of the blood increases to a max. of 0.3 mg. % 12 hrs. after injection of glucose. These and other results given may be explained on the assumption that insulin reacts on substances in the body to produce an intermediate substance which acts on the reducing substances in the blood and is responsible for convulsions. J. B. BROWN

A preliminary note on the blood picture in dogs following experimental atrophic gastritis induced by sodium fluoride. C. D. LEAKE AND G. RITCHIE. *Am. J. Physiol.* **76**, 234 (1926).—Repeated administration of NaF once or twice weekly to dogs over a period of ten weeks resulted in a reduction of the gastric acidity to 0 with a final decline of erythrocyte count of 2 million. The histological changes found were slight atrophic gastritis, moderate extension of red bone marrow and an abnormal deposition of the Fe pigment in the spleen and red bone marrow. J. B. BROWN

The action of adrenaline and ergotamine on the uterus of the rabbit. J. H. GADNUM. *J. Physiol.* **61**, 141-50 (1926).—The effect of adrenaline and ergotamine on the rabbit uterus has been detd. Ergotamine tends to increase the concn. of adrenaline necessary to produce a given contraction. J. B. BROWN

Investigation on the tensile strength of strips of haddock muscle before and after various treatments. J. C. FORBES. *Trans. Roy. Soc. Can.* **20**, Sect. V, 145-53 (1927).—Marked increase in tensile strength was caused by weak alk. (p_H 8-10), by treatment with NaCl, especially acidified concd. NaCl, and by HCHO. Acidity (p_H 1-2) had a pronounced disintegrating effect on the tissue and a pronounced dehydrating effect. Fresh muscle showed a marked decrease in tensile strength when heated to 33° for 30 min. Brining, drying, and especially HCHO increased resistance to heat. A. T. CAMERON

The relaxation of histamine contractions in smooth muscle by certain aldehydes. A. I. KENDALL. *J. Infectious Diseases* 40, 689-97(1927).—K. demonstrates by kymograph tracings the relaxation, by certain aldehydes, of contractions induced in guinea-pig gut and uterus by histamine and certain histamine-like substances. The absence of O on the C atom next the CHO group appears to predispose the aldehyde mol. as a whole toward reactivity whereas the presence of O in this position restrains or prevents the reactivity of the aldehyde radical. The method is of value in the detection of histamine and histamine-like substances.

The effects of formaldehyde on smooth muscle contraction in anaphylaxis. A. I. KENDALL, H. L. ALEXANDER AND JANET A. HOLMES. *J. Infectious Diseases* 41, 137-42 (1927).—HCHO, in suitable, small concns., prevents a sensitized smooth muscle from contracting on contact with its homologous antigen, relaxes anaphylactic contractions induced in sensitized smooth muscle and apparently desensitizes smooth muscle.

The seat of action of veratrine. G. RUSSO. *Arch. sci. biol. (Italy)* 9, 78-87(1926).—Veratrine acts directly upon the muscle.

Comparison of the pharmacological actions of cuprous and cupric salts. G. SPAGNOL. *Arch. sci. biol. (Italy)* 9, 132-45(1926).—Large intravenous dosages of Cu^+ and Cu^{++} salts (CuCl and CuSO_4) in rabbits indicate that for heavy doses, *i. e.*, 0.00027-0.0009 g. mol. Cu/kg. of body weight, both salts are equally toxic. In medium doses, 0.00027-0.00005 g. mol., the Cu^{++} is fatal in 3 hrs., Cu^+ in 15 hrs. The slower action of the cuprous salt may be due to the time required for its oxidation in the body. In slow poisonings the 2 salts become identical in their toxic action.

Influence of osmotic pressure on the absorption of medicinal solutions across the cornea. R. GALLENGA. *Arch. sci. biol. (Italy)* 9, 212-23(1926).

Curari hyperglucemia and insulin. ACHILLE RONCATO. *Arch. sci. biol. (Italy)* 9, 291-304(1927).—Hyperglucemia induced by curari is not overcome by insulin. Hypo-glucemia from insulin is overcome and even changed to hyperglucemia by curari. There is, therefore, a non-reciprocal antagonism between the 2 drugs.

The pharmacological action of magnesium on the neuro-muscular preparation. A. JAFELLI. *Arch. sci. biol. (Italy)* 9, 418-34(1927).

The glucose in blood after intravenous injection of sea water. A. RABBENO. *Biochim. terap. sper.* 14, 171-8(1927).—No change in glucose content results in rabbit blood after intravenous injection of sea water. NaCl or CaCl_2 alone produces glucosuria and also hyperglucemia, while Mg salts induce glucosuria. Therefore, the salts in sea water must be present in physiol. equil.

The so-called "vagus hormone" of Loewi. New experiments on conjugated hearts of dogs. L. PATRIZI. *Boll. soc. ital. biol. sper.* 2, 117-22(1927).—Adrenaline, atropine and especially neurine and pilocarpine have an exciting action upon the heart similar to that of the cardiac nerve. When 2 dogs have a vein of one joined to an artery in the other, then an injection of one of the above drugs into the heart of one dog will affect the heart of the other dog in exactly the same way.

Non-specific irritation therapy in pulmonary tuberculosis. GUSTAV MAURER. *Beitr. klin. Tuberk.* 64, 433-48(1926).

The role of camphor in the treatment of pulmonary tuberculosis. F. L. v. MURALT AND P. WEILLER. *Z. Tuberk.* 46, 341-6(1926).—Favorable results are recorded from the use of camphor in the treatment of 430 cases of pulmonary tuberculosis.

The pharmacological action and behavior in the organism of the two phenylmethylisoxazolecarboxylic acids and other substances containing the oxazole and isoxazole group. MARIA DONINI. *Arch. farmacol. sper.* 43, 51-87(1927).—The 2 isomeric phenylmethylisoxazolecarboxylic acids prepd. by Betti (*C. A.* 10, 600) show considerable difference in pharmacol. behavior. The acid m. 157° is toxic in large doses and produces progressive paralysis. The lethal dose is 5 g. per kg. for frogs and 3 g. per kg. for rats. The isomeric acid, m. 189°, is inert. Of the intermediate products obtained in the synthesis of these acids the most toxic is the amide, which in large doses has a strychnine-like effect with direct action on the spinal medulla. Benzalmethylisoxazolone, from which the amide was prepd., is less toxic. The oxazole group itself appears to be devoid of toxicity, since methylloxazole is inert. Substitution of a Ph group increases the toxicity, phenylmethylloxazole being much more active than dimethylloxazole. The acid m. 157° is excreted for the most part unaltered in the urine, whereas the corresponding amide is entirely broken down. Neither BzOH nor PhOH could be detected.

Pharmacological action of iron in double and complex salts. L. SABBATANI.

Mem. accad. Lincei [6], 1, 20 pp.; *Chem. Zentr.* 1926, I, 3490; cf. *C. A.* 21, 1847.—Mixts. of FeSO_4 and $\text{Fe}_2(\text{SO}_4)_3$ solns. with Na oxalate, citrate and tartrate solns. were investigated. Between the Fe salts on the one hand and the Na org. salts on the other there was mutual antagonism. The poisonous action of the org. salts is only slightly reduced by the Fe salts (the action of the tartrate being most affected), the org. salts influencing FeSO_4 only slightly, and $\text{Fe}_2(\text{SO}_4)_3$ very powerfully. If the org. salts are injected before the Fe salts, they weaken the action of the latter far less than they do when injected simultaneously with the Fe salts. The formation of new complex ions, which begins at a certain concn. of the org. salt, shows itself as a break in the curve of the action of the various mixts. Ferric salts have a powerful, immediate, poisonous action, but because of their rapid conversion into colloidal $\text{Fe}(\text{OH})_3$, which has only a feeble local action, they have little or no after-effect. The influence of the org. salts is therefore of most importance in connection with their min. lethal dose, and is of relatively little significance in symptomatology. The converse is true of ferrous salts, which have a weak immediate effect, but a powerful after-effect. Pure FeSO_4 causes diarrhea, hemoglobinemia, hemoglobinuria, depression, paralysis and general thrombosis, but in conjunction with citrate or tartrate only depression and paralysis, the blood remaining fluid and coagulating with difficulty or not at all. C. C. DAVIS

The problem of the poisonousness of colloidal silver (so-called collargol injury). J. VOIGT. *Z. ges. expl. Med.* 52, 33-40; *Chem. Zentr.* 1926, II, 2456.—A rabbit weighing 2 kg. died after injection of 1 cc. of 12% collargol in 9 cc. of a 0.1% Na protalbinat soln.; this is 0.097 g. of Ag, a quantity which under different conditions would be readily tolerated. Anatomical-microscopical examn. showed an extraordinarily high soly. of the metal. It is believed that there is an unfavorable mutual influence of the different protective colloids, which results in an abnormally high soly. of the Ag. Combinations of colloidal substances for therapeutic use necessitate detailed animal experimentation. C. C. DAVIS

Investigations of coramine and cardiazole. LEON ASHER. *Z. ges. expl. Med.* 52, 197-213; *Chem. Zentr.* 1926, II, 2456.—Coramine is superior to cardiazole in circulatory or respiratory complications. Even at low concns., cardiazole caused convulsions in rabbits and even in 2% soln. in many cases caused their death, when the rabbits were not deeply narcotized. On the other hand coramine was tolerated in 10% soln. and by deeply narcotized rabbits in 20 and 50% solns. The favorable action continued for a prolonged period. Even without interruption of the narcosis, respiration was improved by coramine, in contrast to cardiazole, and so it is an agent of great practical importance. C. C. DAVIS

The action of thyroxin on gas exchange in the rat. W. ARNOLDI. *Z. ges. expl. Med.* 52, 249-59; *Chem. Zentr.* 1926, II, 2610. C. C. DAVIS

The action of synthalin in the animal organism. P. H. SIMOLA. *Z. physiol. Chem.* 168, 274-93(1927).—Synthalin, a guanidine deriv. recently introduced as an insulin substitute for the treatment of diabetes, was administered to sheep and rabbits and its action compared to that of insulin. According to Virtanen and Karström (*C. A.* 21, 771) the decrease in blood sugar brought about by insulin is accompanied by a decrease in inorg. phosphate and an increase in lactic acid. Increased phosphorylation appears to be a characteristic of insulin action. The lowering of blood sugar by synthalin, on the other hand, may or may not be accompanied by a decrease in inorg. phosphate, and where hyperglucemia results there is a great increase in phosphate. An increase in lactic acid occurs, however, as in insulin. Synthalin, even in lethal doses, did not cause any remarkable lowering of blood sugar and in some of the expts. a marked hyperglucemia was observed. The substance is unmistakably toxic and convulsions may occur with relatively high blood sugar. Injection of sugar does not stop these convulsions or prevent the animal's death. The symptoms in general resemble ordinary guanidine poisoning. The animals become uneasy, breathing is labored and defecation frequent. After 3-5 hrs., they become apathetic and the respiration slower and stridorous. There is a copious nasal secretion and a twitching of the muscles. Death occurs with increased dyspnea and asthenia. In the lightest cases the animals recovered after 8-12 hrs. but remained for days without appetite. Post-mortem examn. showed fatty degeneration of the liver and nephrotic changes in the kidney. The lethal dose for sheep was 2.6-2.8 mg. and for rabbits 3.5-4.5 mg. per kg. subcutaneously. A. W. DOR

The action of ultra-violet light, thyroid and parathyroid substances upon an artificial plasma in vitro. H. C. W. VINES. *Endocrinology* 11, 125-35(1927).—A study of the variation in Ca in an aq. soln. (0.6% NaCl, 0.2% NaHCO_3 , 0.1% glucose, dried egg albumin, cholesterol, cholesterol oleate at p_H of 7.4) in the presence of excess solid $\text{Ca}_3(\text{PO}_4)_2$. Parathyroid ext. increases Ca, making the soln. more alk. Increase in

acidity decreases Ca. There is a slight const. increase in Ca after exposure to ultra-violet light. Thyroid ext. increases acidity and also Ca but the former effect is prevented by ultra-violet light. Cholesterol fats in soln. affect the increased Ca caused by ultra-violet light and parathyroid ext. while they are not responsible in the thyroid ext.

H. J. DEUEL, JR.

A criminal case of fatal sub-acute thallium poisoning. L. KAPS. *Wiener klin. Wochschr.* 40, 967-70(1927).—The early symptoms of vomiting, colic and diarrhea were followed by obstinate constipation and anorexia. There were widespread disturbances in the nervous system and degeneration of heart, liver and kidneys. D. B. DILL

The theory of the action of synthalin. H. K. BARRENSCHEEN AND ALFRED EISLER. *Wiener klin. Wochschr.* 40, 1074-5(1927); cf. *C. A.* 21, 3231.—The effect of synthalin on inorg. phosphate and on urinary phosphate excretion is similar to that of insulin.

D. B. DILL

The toxic secondary effects of synthalin. EDUARD SZCZEKLIK. *Wiener klin. Wochschr.* 40, 1075 6(1927).—Dyspepsia and liver damage sometimes follow the partial or complete substitution of synthalin for insulin.

D. B. DILL

The behavior of isoquinoline in the animal organism. MASAO TAKAHASHI. *Z. physiol. Chem.* 169, 297-9(1927).—After injection of 40 g. isoquinoline in dogs, in daily doses of 0.1-0.3 g. as a 10% soln. in olive oil, 1.59 g. of the $PtCl_4$ salt of methylisoquinoline was isolated from the urine. From 15 g. injected in chickens the recovery of the $PtCl_4$ salt of the Me deriv. was 0.5 g. Similar expts. with rabbits were negative. Like pyridine and quinoline, isoquinoline is thus partly methylated in the organism.

A. W. DOX

Intoxication from a thallium preparation. H. LUBRIG. *Pharm. Zentralh.* 68, 561-2(1927).—A case is cited descriptive of all the phenomena following the ingestion by a 2½-year old child of bread smeared with a rat poison contg. Tl and ending fatally.

W. O. E.

The action of photosensitive substances in the isolated frog heart. H. WASTL. *Arch. expl. Path. Pharmacol.* 114, 56-69(1926); *Physiol. Abstracts*, 11, 535.—Hemato-porphyrin and eosin have a more deleterious effect on an isolated frog heart if the heart is irradiated with the light from a half-watt lamp than if it is not. Horse serum delays the onset of this effect.

H. G.

Action of eosin on the central nervous system. A. CLEMENTI. *Arch. fisiol.* 24, 322 42(1926); *Physiol. Abstracts* 12, 61.—The injection of aq. solns. of eosin into the dorsal lymph sac of the frog causes first a slight and transient increase in the reflex excitability; this is followed by a depression, which is assocd. with clonic spasms of the hind limbs and ends in paralysis. If the frogs are exhibited to light, these symptoms appear sooner and are more severe. The direct application of 2 to 4% aq. solns. of eosin on the motor-sensory area of the cerebral cortex of the dog either causes a slight decrease in its faradic excitability or has no effect; in either case this action is not influenced by exposure to light.

H. G.

Hypertonic action of adrenaline following various routes of introduction. P. CLERMONT AND L. GAROT. *Arch. intern. physiol.* 26, 362-88(1926); *Physiol. Abstracts* 12, 52.—The reaction obtained in dogs depends directly on the rate of absorption. Subcutaneous injection produces no effect on blood pressure, but a moderate slowing of the pulse and increase of the respiratory waves on the tracing. Intramuscular injection causes a slight increase of pressure, especially if previously low; the pulse is slowed. If introduced directly into the stomach or intestine there is usually a slight fall of blood pressure, but the effects vary; the adrenaline administered is inactivated by the liver. Rectal administration produces bradycardia, with increased amplitude, but an inconstant hypertonic effect. Intra-arterial injection causes the same results as intravenous administration, but much less marked.

H. G.

Action of selenium compounds on cultures of normal and malignant tissues. A. H. ROFFO. *Bol. inst. med. expl. Buenos Aires* 1, 847-67(1925); *Physiol. Abstracts* 12, 4.—K selenate only allows the growth of chick embryo heart in a diln. of 1 in 10,000 but a sarcoma of a rat only grows in a diln. of 1 in 70,000. If Rb selenate is used, growth of the rat sarcoma only occurs in dilns. of more than 1 in 100,000.

H. G.

The Indian kidney-tea, Koemis Koetjing. A. GRUBER. *Deut. med. Wochschr.* 53, 1299-1301(1927).—A non-toxic ext. of the leaves of Koemis Koetjing, contg. the glucoside *orthosiphonin* and many K salts, is valuable in renal conditions because of its diuretic action.

ARTHUR GROLLMAN

A case of metacetaldehyde poisoning. W. H. WILLCOX AND C. AINSWORTH MITCHELL. *Analyst* 52, 528(1927).—A boy of 16 swallowed by mistake about 5 g. of solid fuel used as a substitute for CH_3OH . The metacetaldehyde content caused very

serious poisoning. It is remarkable that the metacetaldehyde should prove so much more active than the isomeric paraldehyde. W T. H.

The appearance of quinine-resistant lipases in the serum after arsphenamine. W. B. MEYER AND FRANZ BUSCHKE. *Klin. Wochschr.* 6, 987-90(1927).—Injection of arsphenamine into normal individuals does not lead to the appearance of quinine-resistant lipases in the serum. MILTON HANKE

Hormones and narcotics. H. ZONDEK AND H. W. BANSI. *Klin. Wochschr.* 6, 1319-21(1927).—Natural sleep is associated with a decreased concn. of hormones in the limiting surfaces of the cells. Narcotics produce changes in the cell membranes such that hormones are absorbed in decreased amount. MILTON HANKE

Influence on the progeny of thallium poisoning in the mother. K. EHRLHARDT. *Klin. Wochschr.* 6, 1374-5(1927).—Lactating rats, that are receiving a fatal dose of Tl, secrete some of the Tl into the milk. The quantity so secreted is sufficient markedly to inhibit the growth and development of the young and to produce a temporary alopecia, but not sufficient to be fatal. MILTON HANKE

Contractility of the gall bladder. H. ERBSEN AND E. DAMM. *Klin. Wochschr.* 6, 1382(1927).—The surviving gall bladder, not distended, contracts when pilocarpine, histamine, KCl or BaCl₂ is added to the suspension fluid. Atropine, adrenaline, CaCl₂, MgCl₂, hypophysin and pituitrin have an anesthetic effect. The distended gall bladder exhibits some spontaneous contraction. Hypophysin and pituitrin, that have an anesthetic action on the placid gall bladder, produce contractions in the distended gall bladder. MILTON HANKE

Chemotherapy of mouse carcinoma by means of ferment poisons (potassium cyanide). L. KARZAG. *Klin. Wochschr.* 6, 1382-3(1927).—Mice can be made to tolerate fairly large doses of KCN without symptoms. Tumor cells are very susceptible and they do not acquire a tolerance for KCN. The results obtained on carcinomatous mice indicate that KCN is of some value as a preventive and as a curative agent. MILTON HANKE

Uric acid metabolism and insulin. L. KURTI AND G. GYORGYI. *Klin. Wochschr.* 6, 1426-8(1927).—Administration of insulin to normal individuals leads to a retention of uric acid. MILTON HANKE

Action of hydrogenated imidazoles on the blood sugar. FELIX HAUROWITZ AND MAXIMILIAN REISS. *Klin. Wochschr.* 6, 1479(1927).—2,4-Diketodihydroimidazole, 2-iminotetrahydroimidazole and 2-imino-4-ketodihydroimidazole have no action on blood sugar. MILTON HANKE

Chronic mercury poisoning and the danger associated with amalgam. H. FÜHNER. *Klin. Wochschr.* 6, 1545-8(1927).—A bibliographical review. Chronic Hg poisoning has never been noted when the daily excretion of Hg into the urine is only a few hundredths of a mg. A daily excretion of several tenths of a mg. is associated with symptoms of poisoning. Ag amalgam fillings seldom lead to Hg poisoning. Poisoning from this source must be due either to Hg vapor or to soln. of Hg from the amalgam by the saliva. Cu amalgam is unstable and should not be used as a filling material. M. H.

Influence of calcium on the action of the sympathetic on frog's heart. J. TEN CATE. *Arch. néerland. physiol.* 10, 498-509(1926); *Physiol. Abstracts* 11, 534-5.—The heart (*Rana temporaria*) was perfused *in situ*. Perfusion of a Ringer soln. without Ca arrests the heart and abolishes the response to sympathetic stimulation; replacing the Ca leads to increased frequency and amplitude of the beats and enhancement of the sympathetic effect. CaCl₂ can be replaced by equiv. amts. of SrCl₂ or BaCl₂, but the latter is less effective; MgCl₂, CoCl₂ and MnCl₂ are without action; if a Ringer contg. MgCl₂, etc., instead of CaCl₂, is perfused without the previous production of arrest of activity from lack of Ca, the beats finally cease, and the effect of sympathetic stimulation is directly proportional to the activity of the heart at the moment. At the commencement of the period of perfusion with a Ringer without Ca, the effect of sympathetic stimulation is augmented. The disappearance of the sympathetic effect in the absence of Ca is due chiefly to alteration in the contractile power of the heart itself, since the excitability of the nerve falls much more slowly than the contractility of the heart; moreover, direct stimulation is without effect, contrary to what occurs with lack of K. E. H.

Action of sympathetic and vagus on frog heart. J. TEN CATE. *Arch. néerland. physiol.* 10, 544-62(1926); *Physiol. Abstracts* 11, 535.—The automatism of the heart depends on K, the contractility on Ca. If the heart is perfused with a Ringer soln. contg. only 0.1 the normal amount of Ca, it can be shown that the effect of sympathetic stimulation on the rate of beat is still definite when its effect on the amplitude is almost abolished, and an arrested heart can be made to beat again; hence sympathetic stimulation must release Ca and make it available for the contractile process. When the heart

is stopped by perfusion of a Ringer soln. lacking in K, sympathetic stimulation arouses a slow beat of normal or supranormal amplitude, presumably by making K available for the automatic centers. The effects of vagal stimulation were studied in the hearts of *Rana esculenta*. Since Ringer soln. lacking Ca or K abolishes vagal excitability, either one contg. excess of Ca was used, when vagal stimulation only slowed the heart, without reducing the amplitude of the beats (the slowing might be greater than under normal conditions), or one contg. excess of K was perfused, when stimulation of the vagus reduced the amplitude, but did not slow the beats. These results are related to the action of K on automaticity and to that of Ca on contractility; thus K is lost to the heart under vagal stimulation, appearing in the perfusion fluid. Hence sympathetic stimulation brings K and Ca to their resp. centers of activity, while vagal stimulation removes them.

E. H.

The effect of narcosis on the labor pains of the puerperal uterus. H. FRANKEN AND H. SCHLOSSMANN. *Arch. Gynäkol.* 130, 215-20(1927).—CHCl₃ causes marked decrease in labor pains. Ether narcosis causes a less decrease while Narcysten narcosis causes an increase in activity of the labor pains.

HARRIET F. HOLMES

Blood changes in acute experimental lead poisoning. K. FUJITA. *Acta Dermatol.* 9, 48-57(1927); *Ber. ges. Physiol. expll. Pharmacol.* 40, 597.—Addn. of Pb(OAc)₂ to the diet caused in rabbits a distinct decrease of the red and an increase of the white count, and a gradual reduction of fibrinogen and hemoglobin. The resistance of the red cells to hypotonic NaCl was not materially altered.

MARY JACOBSEN

The initial hyperglucemic effect of insulin. M. GUARDABASSI. *Ann. fac. med. chir. (Perugia)* 29, 147-77(1927); *Ber. ges. Physiol. expll. Pharmacol.* 41, 86-7.—A transient hyperglucemia is caused by subcutaneous, and more distinctly by intraperitoneal, insulin injections. It is absent or very slight in thyroidectomized animals, while thyroid feeding exacerbates both hyper- and hypo-glucemia and the toxic effect. Adrenal disease or adrenalectomy has no effect. The hyperglucemia is pronounced in diabetics and absent in castrated animals, although the latter are highly sensitive to insulin. The data are followed by a lengthy discussion on the influence of the various hormones through the medium of the liver.

MARY JACOBSEN

Blood sugar. Comparison of blood sugar curves following ingestion and intravenous injection of glucose. WM. G. LENNOX AND MARGARET BELLINGER. *Arch. Internal Med.* 40, 182-94(1927).—In 100 non-diabetic subjects the curves obtained by the two methods showed a normal degree of correlation in 75% cases, and on repeated detn. on 22 subjects in 87% cases. Glucosuria after injections was more frequent and pronounced and bore little relation to the blood sugar. The relative merits of the 2 methods are discussed.

MARY JACOBSEN

Hypoglucemia and the toxic effect of insulin. G. A. HARROP. *Arch. Internal Med.* 40, 216-25(1927).—The clinical picture of insulin overdosage in man may considerably differ from that usually anticipated. Subjective and prodromal symptoms generally may be slight or entirely missing. Glucose administration to unconscious patients does not always bring prompt relief. In 2 cases the symptoms resembled CO poisoning except for the blood coloring. There is apparently no direct proportion between the degree of poisoning and hypoglucemia, which suggests that an additional toxic action is involved.

MARY JACOBSEN

Physicochemical changes in serum caused by rubidium. A. H. ROFFO AND H. DEGIORGI. *Bol. inst. med. exp.* 2, 955-67(1926); *Ber. ges. Physiol. expll. Pharmacol.* 40, 846.—The intravenous injection of RbCl₂ and RbSeC₄ causes in man and animals a slight decrease of p_H , which depends on the dose and, although less pronounced in man, continues even when the injections are kept up for a certain period of time. The surface tension of the blood is also diminished by RbCl₂ and K₂SeO₄, in some cases by 5 dynes. These changes which are caused by well-tolerated doses indicate a disturbance of the colloidal equil. of the serum affecting the imperviousness of the cell membranes. M. J.

Pharmacological study of solarson. I. Toxicity. P. TESTONI. *Clin. med. ital.* 57, 383-92(1926); *Ber. ges. Physiol. expll. Pharmacol.* 40, 739-40.—An intravenous injection of 0.2 g./kg. kills rabbits in 2.5 hrs., 0.1 g. in 2 days (tonic convulsions). Albuminuria appears already in the 1st 24 hrs. One g./kg. subcutaneously kills in 2 hrs., 0.2 g. in 23 hrs. M.L.D.: 0.025 g. was survived; 0.038 was lethal. II. Anatomical and pathological changes in the organs of animals which died from acute or subacute solarson poisoning. *Ibid* 428-36.—Liver and kidney show the typical As degeneration; the former is less pronounced than in cacodylate and aspirochyl poisoning. III. Effect on blood. *Ibid* 457-65.—The red cell no. and hemoglobin content are raised, the white count is reduced by 0.017 g./kg. Larger doses injure the red cells. IV. Behavior of solarson in the animal body. *Ibid* 466-72.—The excretion is more rapid and com-

plete after subcutaneous than after intravenous injection: 48.5-59.8% against 34-47%.

MARY JACOBSEN

Effect of thyroid substance, adrenaline and insulin on the lactacidogen content of muscle and the phosphoric acid of organs. Y. TERADA. *Folia endocrinol. japon.* 2, 13-15, 302-31(1926); *Ber. ges. Physiol. exptl. Pharmacol.* 40, 809.—The lactacidogen content of the femoral quadriceps of the rabbit, normally 0.28%, is reduced $\frac{1}{2}$ -1 hr. after the injection of 0.15 cc. (0.1%) adrenaline (I) or by feeding 0.8 g. thyroid substance (II) (distributed over 2 weeks). Thyroidectomy (III) causes both an increase and decrease (50:50), insulin (IV) a 33% increase. This antagonism also comes into effect when the drugs are combined. The total P of the blood, heart and kidneys is increased; that of the liver lowered by I to IV. Muscle P is markedly raised by IV and diminished by I to III. Simultaneous injection of I, II and III shows no consistent effect on the P of organs, while the antagonism is apparent in the effect on muscle P. M. J.

Effect of insulin on the platelet count and the relation between insulin and thyroid hormone. Y. IWAI. *Folia endocrinol. japon.* 2, 19-20, 451-77(1926); *Ber. ges. Physiol. exptl. Pharmacol.* 40, 809-10.—Single or repeated doses of insulin decrease the platelet count in man and rabbit. Thyroid feeding hastens the return to normal. Thyroidectomy tends to lower the platelet no. The return to normal is slower than with insulin. The thrombocyte no. reaches a max. 1.5 to 2.5 hrs. after injection of thyroid ext. Conclusion: insulin and thyroid ext. are antagonists.

MARY JACOBSEN

Effect of insulin on the contraction of isolated smooth muscle. Z. KUROZONO. *Folia endocrinol. japon.* 2, 43-4, 221-33(1926); *Ber. ges. Physiol. exptl. Pharmacol.* 41, 143.—The inhibiting effect of com. insulin on uterus and heart as formerly reported by K. cannot be attributed to insulin, since it is also produced by heat-inactivated insulin, by the tricesol used for preservation and by dil. acids of the same p_H as the insulin solns.

MARY JACOBSEN

The action of insulin on the lipoids of blood. IWAKICHI OKU. *Folia endocrinol. japon.* 2, 279-301(1926); *Ber. ges. Physiol. exptl. Pharmacol.* 40, 801.—The lipemia caused by olive oil, lard and cod-liver oil (decreasing in the above order) is attributable chiefly to the fatty acids. Lecithin ranges next, while cholesterol has no const. effect. Alimentary lipemia is suppressed by insulin although to a lesser extent than in hunger.

MARY JACOBSEN

Effect of carbon monoxide and potassium cyanide poisoning on the function of the thyroid. S. IGURA. *Folia endocrinol. japon.* 2, 22, 523-44(1926); *Ber. ges. Physiol. exptl. Pharmacol.* 41, 100.—Daily small doses of CO cause degeneration and atrophy of the thyroid in rats. Thyroid feeding hastens death from CO considerably; thyroidectomy delays it insignificantly. Small daily doses of KCN cause thyroid hypofunction. Thyroidectomized rats survive the controls by $\frac{1}{2}$ the time.

MARY JACOBSEN

Pharmacological action of β -indoethylamine. SEIICHI HASGAWA. *Folia pharmacol. japon.* 4, 12-4, 216-32(1927); *Ber. ges. Physiol. exptl. Pharmacol.* 41, 141.— β -Indoethylamine increases the amplitude of the amphibian heart. Large doses have a tonic and vasoconstrictor effect. The pupil dilator is markedly excited. Intravenous injections, esp. large doses, lower the blood pressure after an initial increase. There is also a central vasoconstrictor effect. Small doses change the rhythm and increase the amplitude of intestinal contractions; large ones have an inhibitory effect. Isolated uterine and bladder muscle are stimulated.

MARY JACOBSEN

Pharmacological studies on aorta strips of the rabbit. NOBUHARU KITAMURA. *Folia pharmacol. japon.* 4, 76-8(1927); *Ber. ges. Physiol. exptl. Pharmacol.* 41, 144.—In expts. according to O. B. Meyer contractions were caused by adrenaline, physostigmine, digitalin, arsenite and Ba, relaxation by strychnine, cocaine, pilocarpine, atropine and quinine. Caffeine, chloral hydrate and nicotine had no effect. M. J.

Experimental studies of intravenous infusion of Ringer-Locke solution containing soluble starch. SEIJI HORI. *Folia pharmacol. japon.* 4, 101-13(1927); *Ber. ges. Physiol. exptl. Pharmacol.* 40, 845.—The lethal dose of infusate and the quantity of urine excreted decrease with the starch concn. There is a transient rise in blood pressure, which is reduced by the exsanguination. Autopsy reveals pulmonary edema and diastolic standstill of the heart.

MARY JACOBSEN

Experimental studies on the subcutaneous infusion of hyper- and hypotonic salt solutions. SUSUMU UYEDA. *Folia pharmacol. japon.* 4, 114-22(1927); *Ber. ges. Physiol. exptl. Pharmacol.* 40, 845.—The lethal dose of infusate is const. for concns. from 0.4 to 4%, and considerably smaller for 5% NaCl and for water. The max. amt. of urine is excreted at 1.5% NaCl. Very low concns. cause hemoglobinuria. Blood pressure and respiration are increased by low and diminished by high concns.

MARY JACOBSEN

Methemoglobin formation. I. The effect of certain gases, acids and alkalies on

the production of methemoglobin by chemicals. CHIKARA SUZUKI. *Folia pharmacol. japon.* 4, 156-79(1927); *Ber. ges. Physiol. exptl. Pharmacol.* 40, 459-60.—The methemoglobin production by KClO_3 , pyrogallol, $\text{NH}_3\text{O.HClO}_3$, KNO_3 and aniline-HCl in fresh rabbit blood *in vitro* is promoted by CO_2 and acids, regardless of the reaction of the agents applied. It is inhibited by alkali, while the effect of O_2 varies. The methemoglobin formation and the effect of CO_2 , acids and alkali on it are more pronounced in blood hemolyzed by water, except for pyrogallol for which the opposite obtains. II. Methemoglobin production by chemicals *in vivo* and the effect of gases, acids and alkalies thereon. *Ibid* 180-94.—The effect of acids and alkalies *in vivo* (mice) is less pronounced than *in vitro*, probably because of the buffer action of the blood. Methemoglobin formation is only slightly promoted by acids. It is inhibited by alkalies. The effect of KClO_3 and KNO_3 is not influenced by CO_2 or acid. MARY JACOBSEN

Effect of chemicals on stimulus conduction between auricle and ventricle. GOMPEI MORITA. *Folia pharmacol. japon.* 4, 247-57(1927); *Ber. ges. Physiol. exptl. Pharmacol.* 40, 459.—The beat rate of the chloralized Straub heart under rhythmic elec. stimulation is the same as in the normal heart. If the frequency of the stimulus exceeds a certain rate the ratio beat rate/frequency becomes $1/2$, $1/3$, etc. In MgCl_2 , caffeine and ergotoxine poisoning the frequency at which the beat rate is reduced to $1/2$ is lower with auricle, than with ventricle stimulation. This points to an interference with stimulus conduction. The latter is apparently not paralyzed by quinine, emetine, cocaine, KCl, curare, CaCl_2 , veratrine, strophanthin, BaCl_2 or camphor since the decrease of beat rate appears at lower frequencies when the ventricle is stimulated. MARY JACOBSEN

Animal experiments on the reduction of blood coagulation time. BUNJI SAWADA. *J. Oriental Med.* 5, 73(1926); *Ber. ges. Physiol. exptl. Pharmacol.* 40, 402.—Na citrate in doses of 0.1-0.2 g./kg. rabbit hastens coagulation. The effect appears soon after the injection and passes a max. 3 hrs. later. Doses of 0.3-0.4 g. have essentially the same effect and are distinctly toxic to rabbits. Na citrate should not be used as a styptic. MARY JACOBSEN

The active principle of opium when smoked. SEIKICHI NAKAJIMA AND SEIKO KUBOTA. *J. Orient. Med.* 6, 1-16(1927); *Ber. ges. Physiol. exptl. Pharmacol.* 40, 850.—At the temp. and pressure of the opium pipe morphine, narcotine and codeine are likely to sublimate. Fifteen % of the opium alkaloids were recovered from the smoke collected on absorbent cotton. The 3 alkaloids were identified. MARY JACOBSEN

The acidosis of syphilis and chemotherapy by means of arsenobenzenes. ORLANDO RANGEL. *Livro Primario Congr. Brasil. Pharm.* Oct., 1922, 117-29.—Mainly a digest of McDonagh's views. MARY JACOBSEN

The cumulative effect of a few heart remedies of the digitalis group. HIROAKI UTSUNOMIYA. *Okayama Igakkai Zasshi* 1927, 71-90; *Ber. ges. Physiol. exptl. Pharmacol.* 40, 852.—Mice received repeated injections of a certain dose. The lethal dose was detd. in rabbits by means of 2 injections. The cumulative effect decreases in the following order: digitalis leaves (digitoxin) > digitamine, digitoline (digitalein) > strophanthine, scillaren > cymarin. MARY JACOBSEN

Comparative study of the action of curarizing poisons on skeletal muscle. RYUZO KATAGI. *Okayama Igakkai Zasshi* 1927, 213-30; *Ber. ges. Physiol. exptl. Pharmacol.* 40, 851.—Isolated gastrocnemii of frogs were studied after 1.5 hrs.' immersion in the toxic solns. Guanidine, adrenaline, tyramine and K in doses smaller than the paralyzing ones caused excitation of the motor endings. Among the poisons which attack the muscle before the nerve paralysis is complete, brucine, strychnine, guanidine, atropine, $\text{N}(\text{Et})_3\text{OH}$ and camphor cause initially excitation, while acetylcholine, $\text{N}(\text{Me})_3\text{OH}$, cinchophen Na salicylate and thebaine have only a paralyzing effect. The range of curarizing action (difference between nerve- and muscle-paralyzing concns.) decreases in the following order: $\text{N}(\text{Me})_3\text{OH}$, brucine, strychnine, acetylcholine, guanidine, tetrodotoxin, adrenaline, atropine, tyramine, K, $\text{N}(\text{Et})_3\text{OH}$, Na salicylate, thebaine, cinchophen. Nicotine seems to range after $\text{N}(\text{Me})_3\text{OH}$ according to Okusima. MARY JACOBSEN

The anomalies in the regulation of blood sugar under Röntgen irradiation. J. HISAMOTO AND M. TAKESHIMA. *Okayama Igakkai Zasshi* 39, 315-31(1927); *Ber. ges. Physiol. exptl. Pharmacol.* 41, 88.—Liver irradiation causes in rabbits an increase in blood sugar when the liver glycogen is high and a decrease when the glycogen is low. In both cases the effect is proportional to the dose. Irradiation of the thorax or lower abdomen of the rabbit causes considerable variations in the blood sugar. In the normal fasting dog liver irradiation is followed by a sugar decrease, more persistent and pronounced than in the rabbit. Man probably reacts in the same manner. M. J.

A new treponemicidal arsenic-bismuth preparation. DONATO BOCCIA AND ROBERTO MAGLIONE. *Rev. sud-americana endocrinol.-immunol., quimioterap.* 10, 491-8

(1927).—Dessy's new prepn. contains 0.02 g. Bi metal and 0.75 mg. As/cc. The tolerated dose is $\frac{1}{8}$ cc./kg. guinea pig. The max. therapeutic dose applied was 5 cc. Bi excretion in the urine begins on the 2nd day and ceases 3 days after discontinuation of the treatment. Intramuscular injections of 3 cc. in men, 1.5–2.0 cc. in women and children every 3rd to 7th day over a period of 10–20 days are almost painless and well tolerated. A kidney function test is desirable although no kidney affections were observed. Primary and secondary lesions disappear rapidly after 2–3 injections; the effect on the former is the same as that of neoursphenamine intravenously. The Wassermann test became negative in a no. of cases, but the short period of observation permits no final conclusion.

MARY JACOBSEN

The action of veratrine on skeletal muscle and an application of our knowledge of the segmentation of the frog gastrocnemius to the problem of the refractory phase of skeletal muscle in veratrine poisoning. S. DE BOER. *Verslag Akad. Wetenschappen Amsterdam* 36, 81–90(1927).—The gastrocnemius muscle of the frog consists of 2 groups of fibers, one of which is innervated by the 8th, the other by the 9th spinal nerve. Chemically as well as electrically the fibers function independently of each other. The tetanic contraction which is associated with intermittent elec. phenomena must be differentiated from the muscle tonus which is maintained by reflex and causes a continuous excursion of the galvanometer provided the current is drawn off monophasically. An induction stimulus applied to either the 8th or the 9th nerve will produce a steady excursion on the electrogram during the entire course of the veratrine contraction. A mechanical effect is apparent only on the ascending and descending parts of the veratrine curve; it is zero at its peak because at this stage the muscle has reached the max. contraction and cannot be shortened any more. Querido's conclusion that at the height of the veratrine contraction the muscle is refractory to induction stimulus is therefore erroneous.

MARY JACOBSEN

Effect of insulin on the morphological and chemical condition of the blood. A. SCHMIDT AND R. SAATCIAN. *Zurnal eksper. biol. mediciny* 4, 353–79(1926); *Ber. ges. Physiol. exptl. Pharmacol.* 41, 86.—The solids of the blood are more or less distinctly increased by insulin. The d. of the serum is slightly lowered but convulsions cause an increase. The petroleum ether ext. is diminished. The non-protein N shows no significant changes. The serum Ca is always lowered; convulsions cause a 30% increase. The changes in Ca are probably detd. by a shifting of the acid-base relation. The inorg. P is always lowered by 30% even in absence of hypoglycemia. There is a 50% increase in convulsions. The following hypothesis is advanced: Insulin promotes the formation of lactacidogen, which is split during the convulsions. The P is swept into the blood.

MARY JACOBSEN

Effect of lecthin on curare poisoning. A. VINOGRADOV. *Zurnal eksper. biol. mediciny* 4, 657–63(1927); *Ber. ges. Physiol. exptl. Pharmacol.* 40, 851.—When given before the curare poisoning lecthin either aggravates or counteracts the action of curare, the effect depending on its dose and mode of administration.

MARY JACOBSEN

Effect of morphine on the gastric secretion of dogs in hunger. A. SMIRNOV AND V. SIROKIJ. *Zurnal eksper. biol. mediciny* 4, 694–711(1927); *Ber. ges. Physiol. exptl. Pharmacol.* 41, 72–3.—The effect of morphine on gastric secretion is controlled by the vagus center. Intense secretion is produced by 0.005–0.01 g. morphine, a max. being reached in 1 1.5 hrs. Secretion begins 1.5–2 hrs. after the injection of 0.05 to 0.06 g. In some dogs the promptest and greatest effect is produced by 0.01; in others by 0.005 g. The secretion caused by morphine is checked for 1.5 to 2 hrs. by 0.0005 to 0.001 g. atropine. Vagotomy at the neck abolishes secretion.

MARY JACOBSEN

The vagotropic action of adrenaline. A. SMIRNOV AND V. SIROKIJ. *Zurnal eksper. biol. mediciny* 4, 851–62(1927); *Ber. ges. Physiol. exptl. Pharmacol.* 40, 848.—The vagotropic action of adrenaline is favored by an increased tonus of the vagus centers. The antagonism adrenaline-Mg resembles that of Ca-Mg. Adrenaline is an amphoteric hormone acting on both vagus and sympathetic; it acts on the former directly. M. J.

A biochemical investigation of tripanosome treatment with the "Bayer 205" preparation. O. A. STEPPUN, G. TZEISS AND S. S. BRYUKHONENKO. *Trans. Sci. Chem. Pharm. Inst.* 1923, No. 3, 49–52.—The influence of the "Bayer 205" prepn. on tripanosomes consists of two factors; it acts as a colloid with a large mol. and in a specific grouping of the atoms; upon injecting into the organism it causes a perturbation of the physicochemical state of the juices and prevents the coagulation of the blood. Another direct influence of the prepn. on tripanosomes is due to its being a carrier of complex groups of the naphthalene series.

J. S. JOFFE

Several pharmacological observations on the "Bayer 205" preparation. A. S. SOKOLOV. *Trans. Sci. Chem.-Pharm. Inst.* 1923, No. 3, 64–8.—Doses of the prepn.

from 0.8 to 1.5 g. are lethal for rabbits weighing 2000 g. The characteristic symptoms of poisoning are produced: convulsions of the neck muscles and extremities. A frog can stand 10 times as much of the prepn. as the rabbit per unit wt. Upon injecting into the vein it increases the blood pressure and acts as a depressive on the breathing. The increase in blood pressure is apparently due to the spasms occurring in the periphery of the blood vessels.

J. S. JOFFE

Advantages of ethylene-oxygen in general anesthesia. G. A. JOHNSTONE. *Am. Med.* 33, 367-70(1927).

FRANCES KRASNOW

The treatment of approaching and existing diabetic coma. J. A. BUCHANAN. *Am. Med.* 33, 408-11(1927).—Details of insulin treatment are given and discussed briefly.

FRANCES KRASNOW

Ethylene as an anesthetic for general surgery. HUGH CABOT AND H. K. RANSOM. *Ann. Surgery* 86, 255-9(1927).

FRANCES KRASNOW

Blood changes under ethylene anesthesia. H. H. TROUT. *Ann. Surgery* 86, 260-7(1927).— C_2H_4O anesthesia produces less alteration of the blood sugar, no appreciable change in either the coagulation time or the bleeding time, and only a slight disturbance of the native complement when compared with any other of the now commonly employed anesthetics.

FRANCES KRASNOW

The anesthetic preferences of American surgeons (compiled from reports received from six hundred and forty surgeons). EDWIN MAC D. STANTON. *Ann. Surgery* 86, 273-7(1927).—Ether is used in 85% of the cases, ethylene in 5%, N_2O and O in 4%, ethylene and N_2O in 1% and $CHCl_3$ in practically none.

FRANCES KRASNOW

The colloidal lead treatment of malignant neoplasms. W. S. STONE AND L. F. CRAVER. *Ann. Surgery* 86, 347-61(1927).—Intravenous injection of lead does not offer a cure for malignant neoplasms. In cancer of the breast, especially in the bone metastases from the tumor, the lead alone can produce favorable changes. In malignant osteogenic sarcoma lead in conjunction with radiation offers a valuable method of treating such tumors.

FRANCES KRASNOW

Change in the lymphatic apparatus following arsenic poisoning. R. STRAUMANN. *Deut. Z. ges. gericht. Med.* 9, 266-90(1927).—The effect is described in detail.

F. K.

Fatal poisoning with a mixture of common alum, zinc sulfate and copper sulfate. ERNST ZIEMKE. *Deut. Z. ges. gericht. Med.* 9, 291-301(1927).—Case report and discussion.

FRANCES KRASNOW

The pathological anatomy of the vegetative nervous system in methanol poisoning. B. MOGLINITSKIE. *Deut. Z. ges. gericht. Med.* 9, 302-11(1927).—MeOH is a specific poison for the vegetative system.

FRANCES KRASNOW

The quinquivalent compounds of antimony in the treatment of kala-azar. I. Stibosan (von Heyden 471); an analysis of the results of the treatment of the first 104 cases. L. E. NAPIER. *Indian J. Med. Research* 14, 263-79(1926). II. No. 693 (von Heyden); an analysis of the results of the treatment of the first 61 cases. *Ibid* 15, 181-6(1927).—No. 693 is very valuable.

FRANCES KRASNOW

The treatment of Wassermann-positive cases of leprosy by a new oil-soluble mercury preparation. E. MUIR. *Indian J. Med. Research* 14, 291-2(1926).—Hg 33 (2 myristoxymercuri-3-hydroxybenzaldehyde) in hydnocarpus oil is a safe and effective remedy in the treatment of leprosy when the Wassermann reaction is positive.

F. K.

The treatment of plague with mercurochrome-220 soluble. P. P. B. NAIDU AND SHAMSHER JANG. *Indian J. Med. Research* 14, 323-7(1926).—Mercurochrome-220 sol. is lethal to the plague bacilli in a diln. of 1-3200 after contact for 15 min. When injected hyperdermically the drug is not lethal to rats in doses of 10 mg. It is not lethal to rabbits in doses up to 10 mg. per kg. wt. when inoculated intravenously. Doses, whether single or repeated, totaling from 5 to 73.5 mg., have no influence on plague in rabbits and rats.

FRANCES KRASNOW

An experimental investigation into the action of organic compounds of antimony. R. N. CHOPRA. *Indian J. Med. Research* 15, 41-8(1927); cf. C. A. 20, 2371. —All org. compds. of Sb produce a fall in the systemic blood pressure after intravenous injection. The acidity of the soln. is not an important factor. The pressure in the pulmonary artery and in the interior vena cava rises. With small doses the rise is small and is immediately compensated for. The blood vessels of the intestines, liver and spleen dilate; the kidney shows slight contraction. The influx of a large amt. of blood into the spleen and liver is probably an important factor in the curative effect of these compds. The respiration is only slightly stimulated with some compds. (tartrates) but with others it becomes irregular and jerky.

FRANCES KRASNOW

***Psoralea corylifolia* (Babchi). Its constituents, their pharmacological action and therapeutic properties.** R. N. CHOPRA AND NIHAR RANJAN CHATTERJEE. *Indian*

J. Med. Research 15, 49-56(1927)—The active principle of this plant is an essential oil. A fixed oil and a resin occur in large quantities but these are not active pharmacologically. Traces of a substance of alkaloidal nature are also present. FRANCES KRASNOW

The relationship of the color of rabbits to their susceptibility to insulin. H. W. ACTON AND J. P. BOSE. *Indian J. Med. Research 15, 89-96(1927)*.—Insulin causes a smaller reduction in the blood sugar of the albino than of the black rabbits. The adrenaline content in the blood of the albino animal is higher than in the black. F. K.

Studies on the toxicity for tetrachlorethylene, a new anthelmintic. A. S. SCHLINGMAN AND O. M. GRUHZIT. *J. Am. Vet. Med. Assoc. 71, 188-209(1927)*— C_2Cl_4 like CCl_4 is more hepatotoxic than nephrotoxic. The lesions of this new anthelmintic are not as severe as CCl_4 . Chickens show the greatest tolerance. Next in order are puppies, cats, foxes, sheep, cattle and horses. FRANCES KRASNOW

Anthelmintic efficiency of kamala and tetrachlorethylene in the treatment of chickens. A. S. SCHLINGMAN. *J. Am. Vet. Med. Assoc. 70, 514-9(1927)*; cf. C. A. 20, 1274, 2019.—In 1 g. doses kamala is an efficient teniacide and is not toxic for birds. In combination with 1 cc. of C_2Cl_4 its efficacy is greatly reduced. FRANCES KRASNOW

A treatment for liver-fluke infestation in goats. J. N. SHAW AND B. T. SIMMS. *J. Am. Vet. Med. Assoc. 71, 723-7(1927)*— CCl_4 in doses of 1 cc. is a satisfactory treatment. FRANCES KRASNOW

Insulin-glucose in surgical shock, with observations on two cases. M. N. TUASON. *J. Philippine Islands Med. Assoc. 7, 283-6(1927)*. Good results were obtained. FRANCES KRASNOW

The treatment of undulant fever by mercurochrome-220. G. R. ROSS AND A. P. MARTIN. *J. Trop. Med. 30, 165-70(1927)*.—Results are inconclusive. F. K.

The blood sugar of normal subjects after the intravenous injection of insulin. AARON BOBANSKY AND SUTHERLAND SIMPSON. *Quart. J. Exptl. Physiol. 17, 57-64(1927)*—The rate of development of hypoglycemia in adult men, after intravenous injection of 2 units of insulin, is constant, after a possible but in any case very brief latent period. The min. sugar values are reached at a definite time, which is indicated about 18 min. after the injection. Recovery begins immediately after the min. sugar value has been reached. It is complete in lean subjects within 75 min. In overweight subjects the rate of recovery seems slower. FRANCES KRASNOW

The effects of insulin injection upon the body and organs of the white rat. P. T. HERRING. *Quart. J. Exptl. Physiol. 17, 119-24(1927)*—Insulin in doses insufficient to produce convulsions has no effect upon the rate of growth in white rats. Insulin injection has no appreciable effect on the wt. of the thyroids, pituitary body, suprarenals, thymus, spleen, heart, kidneys, liver, testes and ovaries. The islands of Langerhans are increased in size and stain more deeply with eosin. FRANCES KRASNOW

The influence of temperature on the course of strychnine tetanus. G. F. LORENZ. *Z. Biol. 85, 167-74(1926)*.—Physiological. FRANCES KRASNOW

Changes in physiological function of the nerves through the influence of amines like choline and neurine. J. I. PERICHANJANZ. *Z. Biol. 85, 289-98(1926)*.—The immediate effect of choline is to weaken greatly the tissue although at the end of 1.5 hrs. of treatment its function is entirely preserved. The cond. is only slightly impaired. In concns of 1% neurine lowers greatly the nerve irritability. Washing with normal NaCl soln. does not restore the function. MeCN also depresses the nerve activity. In this instance perfusion with NaCl soln. restores the irritability. Urea increases nerve irritability and cond. FRANCES KRASNOW

Changes in the ventricular contraction due to calcium chloride and potassium chloride. E. HOLZLOHNER. *Z. Biol. 85, 485-98(1927)*.— CaCl_2 causes marked retardation of the diastolic descent in the mechanogram with a corresponding extension on the electrocardiogram. While, by means of CaCl_2 , the velocity rise is retarded, there appears an acceleration of the mechanogram. The reverse is true with KCl. Just as in the case of KCl and the activity at the anode, it is more difficult to influence the flow at the base than at the apex. FRANCES KRASNOW

Toxicity of zinc. V. G. HELLER AND A. D. BURKE. *J. Biol. Chem. 74, 85-93(1927)*.—The possibility of poisoning from buttermilk stored in Zn-lined containers was investigated. Buttermilk normally contains a trace of Zn but the amt. is increased with the acidity of the milk, the time of storage and the newness of the Zn container. When pure Zn dust, ZnO , or certain Zn salts are added to a normal ration in amts. as great as are ever found in contaminated foods, there was no interference with growth, reproduction and normal functions of the rat through 3 generations. No pathol. conditions were found in the organs of the rat and the amt. of Zn was only slightly larger than that nor-

mally present. Zn is primarily excreted through the feces though in Zn-fed animals there is a slight increase in the quantity in the urine. A. P. LOTHROP

The nitrogen metabolism in experimental subacute arsenic and antimony poisoning. EMIL PRIBYL. *J. Biol. Chem.* **74**, 775-81 (1927).—In exptl. subacute poisoning in 4 rabbits by Na_2AsO_3 and by Sb K tartrate there is an increase in the non-protein N in the blood. The increase is more apparent in As poisoning and is due to a rise in the urea N. The rise in non-protein and urea N is assocd. with an increase in these substances in the urine. The NH_3 N quotient in the urine of the poisoned rabbits seems to be inversely proportional to the urea-N quotient. The acceleration of protein metabolism is attributed mainly to increased autolysis of tissues. A. P. LOTHROP

Detoxication of benzoic acid in man. J. I. BRAKEFIELD. *J. Biol. Chem.* **74**, 783-5 (1927).—Doses of BzONa which would yield 5-6 g. of BzOH were given to subjects who felt no ill effects from the ingestion of such large amts. of the BzONa . The acid was detoxicated in 10 hrs and was excreted as hippuric acid. In no case was there a detectable amt. of benzoylglucuronic acid present in the urine, a compd. which is found under similar circumstances in the urine of the dog and pig. A. P. LOTHROP

The effect upon rats of long-continued ingestion of zinc compounds, with especial reference to the relation of zinc excretion to zinc intake. KATHERINE R. DRINKER, PHIBBE K. THOMPSON AND MARION MARSH. *Am. J. Physiol.* **81**, 284-306 (1927); cf. *C. A.* **21**, 2325.—Daily doses of Zn, ranging from 0.5 to 34.4 mg. in the form of ZnO , $(\text{AcO})_2\text{Zn}$, Zn citrate and Zn malate over periods of from 35 to 53 weeks had no noticeable effect on the health of the animals (rats), nor did Zn accumulate in the tissues. Most of the Zn given was excreted in the feces, but a small fraction left the body through the kidneys. J. F. LYMAN

The effect of some secretogogs on the chemical composition of the pancreatic juice. E. V. STILL AND O. W. BARLOW. *Am. J. Physiol.* **81**, 341-8 (1927).—Four types of secretogogs were employed: secretin prepns; vasodilating; parasympathetic nerve ending stimulants; HCl in the intestine. Each type of secretogog gave a characteristic type of juice. Those juices that were high in H_2O and of low sp. gr. were high in lipase, while those that were high in protein and of high sp. gr. were relatively high in trypsin. J. F. LYMAN

The prevention of tetany by oral administration of magnesium lactate. W. F. WENNER. *Am. J. Physiol.* **81**, 392-404 (1927); cf. *C. A.* **21**, 1489.—Continuous oral administration of Mg lactate was an effective agent in the prevention of tetany in parathyroidectomized dogs; the lactates of Cd, Na and K were without effect. Mg appeared to keep the Ca content of the blood above the tetany level, possibly by combining with the excess P and thus keeping the Ca in solu. J. F. LYMAN

Morphine intoxication in adrenalectomized rats. A. TORINO AND J. T. LEWIS. *Am. J. Physiol.* **81**, 405-13 (1927).—Adrenalectomized rats 2 weeks after operation were highly susceptible to morphine, usually succumbing to 0.1 the lethal dose for normal rats. The amt. of morphine required to produce hypoglycemia in rats was only about 0.1 as much in the adrenalectomized animal as in the normal. J. F. LYMAN

Sensitiveness of adrenalectomized rats to certain toxic substances. C. A. CRIVELARI. *Am. J. Physiol.* **81**, 414-21 (1927).—Two or three weeks after adrenalectomy rats are more sensitive than normal rats to the toxic action of KCN, nicotine, acetonitrile and histamine. J. F. LYMAN

The effect of cobalt and insulin hypoglycemia in rabbits. N. R. BLATHERWICK AND M. SAHYUN. *Am. J. Physiol.* **81**, 560-2 (1927).— $\text{Co}(\text{NO}_3)_2$ was without appreciable effect on the insulin hypoglycemia in rabbits, contrary to the results of Bertrand and Macheboeuf (*C. A.* **20**, 3041). J. F. LYMAN

The influence of potassium iodide and thyroid preparations upon the blood sugar curve. OESTEN HOLSTI. *Acta med. scand.* **66**, 461-6 (1927).—The effect of KI and of thyroid medication was studied in 6 patients with subnormal blood sugar curves, whereby only the latter caused a rise in the curve which persisted even a month after treatment. Thyroid medication is indicated in such cases also from a clinical point of view. S. MORGULIS

The physiological indifference of capsanthin. B. V. ISSEKUTZ AND L. ZECHMEISTER. *Biochem. Z.* **185**, 1-2 (1927).—Capsanthin is the red pigment of ripe paprika and resembles somewhat carotins but has the formula $\text{C}_{44}\text{H}_{68}\text{O}_2$. About 4 g. can be obtained from 1 kg. paprika shells. Physiologically the pigment is inactive, probably because of its slight soly. S. MORGULIS

Further studies on the optimum dosage of active iron oxide for influencing metabolism. GERHARD ROSENKRAZ. *Biochem. Z.* **185**, 320-7 (1927).—The oral administra-

tion of 2.5-5 mg. of Baudisch active iron oxide per kg. and per day increases the utilization of food in the intestine. S. MORGULIS

The alteration of pharmacological action of autonomic nerve drugs through capillary active substances. L. ASHER AND N. SCHEINFINKEL. *Biochem. Z.* **186**, 87-94 (1927).—Atropine can be made a strongly stimulating drug for the vagus nerve through the influence of cholates as well as caprylic alc. and certain quinine derivs. Organ exts., except those of liver, do not invert the action of atropine. The addn. of capillary active substances to the frog heart treated with ergotamine causes definite acceleration when the vagus is stimulated, whereas ergotamine alone paralyzes the accelerans nerve. S. M.

The central regulation of the water metabolism. IV. The inhibition of the diuretic action of caffeine and theobromine through midbrain narcosis. HANS MOLITOR AND E. P. PICK. *Biochem. Z.* **186**, 130-8 (1927); cf. *C. A.* **20**, 2532.—Small, non-narcotic doses of chloretone or isopral inhibit the diuretic action of caffeine and theobromine in rabbits; certain prepn. of Caldrian act similarly but much larger doses are required. Luminal in non-narcotic doses inhibits the water diuresis in dogs. Chloral hydrate increases caffeine diuresis in small narcotic doses (cerebral narcosis) but with larger doses causing deep narcosis (midbrain narcosis) the diuresis is stopped. Paraldehyde, a cerebral narcotic, increases caffeine diuresis through the inhibition of the diuretic center, while the simultaneous administration of paraldehyde and chloretone completely suppresses caffeine diuresis. S. MORGULIS

Solubility and distribution of chloroform in blood. HANS WINTERSTEIN AND ELSE HIRSCHBERG. *Biochem. Z.* **186**, 172-7 (1927).—The max. soly. of CHCl_3 at room temp. in H_2O is 0.55% (by wt.); 0.5% in physiol. soln., 0.56-0.77% in serum or 0.75-0.86% in whole blood. The distribution of CHCl_3 between cells and plasma depends upon the absolute concn. of the CHCl_3 . At satn. the concn. in the cells is almost double that in the plasma, whereas with low concns. of CHCl_3 the cells may contain 4-6 times as much as the plasma. This leads to the conclusion that adsorption plays an important part in the distribution of CHCl_3 in the cellular elements of the blood. S. M.

Physicochemical studies on illumined proteins. I. Changes in serum albumin exposed to ultra-violet rays and their relation to heat coagulation. MONA SPIEGEL-ADOLF. *Biochem. Z.* **186**, 181-93 (1927).—Electrolyte-free serum albumin coagulates under the influence of ultra-violet light as under the influence of heat, but the coagulum cannot, as in the latter case, be converted into a water-sol. product by treatment with alkali and subsequent dialysis. Ultra-violet light causes changes in serum albumin in the presence of acids or alkalies under conditions under which it generally escapes alterations through heat. Serum albumin exposed to ultra-violet light in the presence of HCl can be pptd. by subsequent addn. of salt, which is unlike the behavior of the heat-treated material. Even large concns. of neutral salt do not prevent the coagulation of serum albumin by ultra-violet light, but the pptn. is inhibited by salts with polyvalent ions. On the contrary, KSCN neither inhibits the pptn. by ultra-violet rays nor does it aid in the resoln. of the coagulum as it does in heat coagulation. S. MORGULIS

The effect of arsenic on the hemolysis by raying and water. L. LÖHNER. *Biochem. Z.* **186**, 194-202 (1927).—The non-sensitized erythrocytes of rabbits undergo hemolysis at an altitude of 1650 m. under the influence of the sunlight in spring. The blood cells from various other species behave similarly, and even the intensity of the ultra-violet rays of the winter sun is sufficient for this purpose. Solns. of As_2O_3 , which increase the resistance of red blood cells to water, saponin or bile hemolysis, are not effective against the hemolyzing action of the light. On the contrary, suspensions of red cells in As_2O_3 solns. may even betray an accelerated hemolysis when exposed either to sunlight or to artificial illumination with ultra-violet rays, which indicates that As is a sensitizer to x-rays and ultra-violet rays. S. MORGULIS

Effect of sex on alcohol action. EMIL ABDERHALDEN AND ERNST WERTHEIMER. *Biochem. Z.* **186**, 252-4 (1927).—Female mice are much more resistant to chronic alc. poisoning than male animals. S. MORGULIS

Effect of increased calcium administration on the dystrophic calcification of the kidney in rabbits. IGOR REMEZOV. *Biochem. Z.* **187**, 51-6 (1927); cf. *C. A.* **20**, 1847.—Intravenous injections of Ca salts increase considerably the dystrophic calcification process in the ligated kidney of the rabbit as well as in the normal kidney. No definite conclusions can be drawn from subcutaneous Ca injections; neither does feeding of Ca salts produce any definite rise in Ca content of the dystrophic kidney. The normal kidney shows a tendency to an increased Ca content under all conditions of administration. The satn. of the tissues surrounding the calcified kidney with Ca salts has a strong influence on the calcification process. S. MORGULIS

Observations on the consequences of intraperitoneal administration of phenyl-

alanine and tyrosine to rabbits with denervated kidneys. N. F. SHAMBOUGH AND G. M. CURTIS. *Biochem. Z.* **187**, 437-43 (1927).—Tyrosine inhibits the strong urine excretion due to denervation or the euphylin diuresis. Even in acute expts. the administration of tyrosine produced serious morphological injury in the liver. Denervation does not prevent the kidney from remaining normal for a long time. S. M.

The behavior of phenylalanine and tyrosine under the influence of purine diuresis. N. F. SHAMBOUGH. *Biochem. Z.* **187**, 441-460 (1927).—Intraperitoneal injection of a slightly alk. NaCl soln. inhibits the effect of a specific diuretic. A comparison of the diuresis resulting from the peritoneal injection of phenylalanine and tyrosine or of a specific diuretic reveals a different reaction of the organism towards these 2 amino acids. Repeated tyrosine injections cause serious liver injury. By the oral administration of phenylalanine and tyrosine no differences appear during an exptl. interval of 6 hrs. S. MORGULIS

A sample of "pot-curare." C. G. SANTESSON. *Skand. Arch. Physiol.* **52**, 209-21 (1927).—Curare ext. packed with palm leaves in burned earthenware pots is an article of exchange among South American Indians. It has a very variable potency. An analysis of one of the best samples of "pot-curare" showed the presence of 8% ash rich in K_2SO_4 and Mn; the poisonous alkaloid protocurarine ($C_{19}H_{25}NO_2$?); the much less effective alkaloid protocurine $C_{20}H_{27}NO_3$; the insol. and non-poisonous proto-curidine, $C_{19}H_{21}NO_3$, and at least one curine-like base which in large doses causes paralysis in frogs with disturbance of heart action. S. MORGULIS

The effects produced by the inhalation of hematite and iron dusts in guinea pigs. H. M. CARLETON. *J. Hyg.* **26**, 227-34 (1927).—Hematite inhalation causes an immediate proliferation of alveolar epithelium and a mild bronchitis. The reaction is much less than with flint, ground pitcher, feldspar, or china clay dusts. Iron dust is more harmful than hematite, causing a greater inflammatory reaction and some fibrosis. JOHN T. MYERS

The effect of mineral acid on acid-base regulation in health and in nephritis. G. C. LINDER. *Quart. J. Med.* **20**, 285-302 (1927).—Dil HCl in quantities corresponding to 500-1000 cc of 0.1 N HCl per day were given to 4 normal persons and 6 nephritics for from 2 to 4 days. In normal cases, a quantity of fixed base was available for excretion with the acid. This was exhausted in 2 or 3 days and its place taken by NH_3 . In chronic hydremic nephritis without gross edema, there was an adequate response in NH_3 formation but the supply of fixed base was lacking. Azotemic patients showed a diminished power to form extra NH_3 . This defect became greater as renal function failed. In compensation there was a greater excretion of fixed base derived largely from cellular waste. The serum chlorides increased, and total base, bicarbonates and pH decreased. In 2 cases with greatly impaired renal function a severe acidosis followed the administration of HCl. JOHN T. MYERS

Hypoglycemic properties of galegine sulfate. H. SIMONNET AND G. TANRET. *Bull. soc. chim. biol.* **9**, 938-27 (1927); see *C. A.* **21**, 3088. L. W. RIGGS

Action of bile and of bile salts upon cardiac conductivity and excitability. LOUIS LYON-CAEN. *Compt. rend. soc. biol.* **97**, 216-7 (1927).—Expts. were made with the frog heart by intraperitoneal injection, or injection into the lymph sacs, of pure dog bile, also of 1 to 4% solns. of Poulenc bile salts in physiol. saline. In a second series the heart was impregnated directly. Cardiac conductivity was diminished by bile and by 1% solns. of the salts. The excitability was diminished only by solns. of bile salts of a concn. of 4% and upwards. L. W. RIGGS

Reinforcement of immunity by the injection of starchy substances. J. A. SICARD, JEAN PARAF AND ROBERT WALLICH. *Compt. rend. soc. biol.* **97**, 217-9 (1927). L. W. RIGGS

Peripheral vasomotor action of extracts of the posterior lobe of the hypophysis. AMIAUX, L. BROUHA AND H. SIMONNET. *Compt. rend. soc. biol.* **97**, 233-4 (1927).—Tests with dogs show that the ext. of the posterior lobe of the hypophysis exercises a peripheral hypertensive action. This action is produced by doses which modify neither the general blood pressure nor the cardiac rhythm. The action, when the injection is made in the paw of the dog, does not depend on the integrity of the nerve connections of the paw, but on the local vasomotor tonus existing in the paw at the moment of injection. This technic may be employed for standardizing post-hypophysis preps. L. W. RIGGS

Variations in the glucose content of blood following intravenous and intracardiac injections of histamine. S. KATZENELBOGEN AND A. ABRAMSON. *Compt. rend. soc. biol.* **97**, 240-1 (1927).—Fatal doses of histamine in rabbits and guinea pigs are accompanied by hypoglycemia; when the reaction is slight or moderate, hyperglycemia results. L. W. RIGGS

Hypoglucemic action of ergotamine in diabetes. HENRI MORETTI. *Compt. rend. soc. biol.* **97**, 320-4 (1927).—Ergotamine administered hypodermically or by the gastric route caused variable reductions of glucemia and of glucosuria in the 7 cases studied, and is capable of acting in insulin resistant cases. L. W. RIGGS

Action of x-rays on the tumor of Rous. A. LACASSAGNE, C. LEVADITI AND J. GALLOWAY. *Compt. rend. soc. biol.* **97**, 336-8 (1927).—Fresh fragments and filtrates from the tumor of Rous retain their virulence, notwithstanding their treatment with x-rays, acting either upon the tumor *in vivo* following late inoculation, or *in vitro*. Small doses of the rays properly administered arrest the development and sterilize such a tumor left in place. L. W. RIGGS

Action of the calcium ion on the excitability of the cardiac accelerator nerves. J. J. BOUCKAERT AND EDW. CZARNECKI. *Compt. rend. soc. biol.* **97**, 353-6 (1927).—Expts. with dogs indicated that a diminution in Ca ions lessened the excitability of the cardiac accelerator nerves. **Condition of excitability of secretory nerves.** *Chorda tympani.* J. J. BOUCKAERT AND JEANNE HURYNOWICZ. *Ibid* 356-8.—The diminution of Ca ions acts upon the chorda tympani, the same as upon other nerves of a parasympathetic nature, to diminish its excitability. **Bile secretion after injection of decalcifying salts.** J. J. BOUCKAERT AND SAADI-NAZIM. *Ibid* 359-60.—Tests with dogs showed that the reaction of the hepatic cells to the injection of bile is identical before and after the injection of decalcifying salts. This fact supports the idea of nonintervention of the nervous system in the secretion of bile. L. W. RIGGS

Experimental lead poisoning. Nitrogen metabolism. M. PAVLOFF. *Compt. rend. soc. biol.* **97**, 361-2 (1927); cf. following abstr.—Rabbits, cats and dogs were the subjects used. The first stage of plumbism, about 3 months in duration, is accompanied by a loss of wt. of 13 to 22%. The urine diminishes in daily quantity up to the end of poisoning, when it may be but 50%, and its acidity increases. During the first weeks the quantity of urinary N increases as the wt. of the subject decreases. Later as the body wt. becomes more stable the quantity of urinary N diminishes. The secretion of creatine is intensified during the first and last periods of the intoxication. The total N of the blood diminishes slowly, the residual N is lowered during the first period and remains below normal throughout the intoxication. Uric acid in the blood is increased during the first and last periods; in the middle period the uric acid in the blood approaches the normal figure. The elimination of uric acid in the urine is diminished. L. W. RIGGS

Experimental lead poisoning. Sugar, lipid and mineral metabolism. M. PAVLOFF. *Compt. rend. soc. biol.* **97**, 430-1 (1927); cf. preceding abstr.—At the beginning of Pb intoxication the blood sugar increases; it attains its max. toward the middle of the term of poisoning and then diminishes progressively to normal. Lipoids produced at the expense of cholesterol increase and cholesterol usually increases during the first period of intoxication. Toward the end the cholesterol approaches the normal figure or may fall below. With mineral compds. there is first an enrichment due to the passage of chlorides from the cells to the blood. The proportion of Ca diminishes. During the poisoning the coagulability, viscosity and fibrinogen of the blood increase. L. W. R.

Action of carbonic acid by inhalation on the respiratory apparatus. S. BONNAMOURE, MILHAUD AND J. LANGÉNEUX. *Compt. rend. soc. biol.* **97**, 483-4 (1927); cf. *C. A.* **21**, 2739.—Rabbits were subjected to inhalations of mixts. of air and CO₂ contg. from 15 to 60% of CO₂. The resulting symptoms agree with those observed in animals subjected to subcutaneous, intraperitoneal or intrarectal injections of CO₂. L. W. RIGGS

Prolonged anticoagulating action of hirudin and leech extracts administered subcutaneously. A. JOSSERAND AND J. JEANNIN. *Compt. rend. soc. biol.* **97**, 493-5 (1927).—A rabbit weighing 2 kg. received a subcutaneous injection of a maceration of 6 leech heads in 10 cc. physiol. saline. Before injection the time of coagulation of a drop of blood on a slide was 4 min., 2 hrs. after the injection it was 10 min., 6 hrs. 21 min., 14 hrs. 14 min., 21 hrs. 9 min. and 25 hrs. 4.5 min. The subcutaneous injection of hirudin causes a hypocoagulability which persists for several days which returns progressively to normal. L. W. RIGGS

Cholesterol and intoxication by carbon monoxide and by hydrogen arsenide. G. MOURIOUAND AND A. LEULIER. *Compt. rend. soc. biol.* **97**, 498-9 (1927).—Guinea pigs subjected to illuminating gas and to H₃As showed no significant change in the distribution of cholesterol in the suprarenals, spleen, liver, lungs or blood. L. W. R.

Chemical regulation of cardiac activity. Effect of certain tissue products on the coronary circulation. L. STERN, S. RAPOPORT AND A. SCHARIKOWA. *Compt. rend. soc. biol.* **97**, 509-11 (1927).—Perfusion expts. with the isolated hearts of cats and rabbits were made by the method of Stern and Rothlin (cf. *C. A.* **14**, 1138, 2210). Coronary

flow is lessened by preps. of thyroid, ovary, testicle, spleen, liver, muscle and brain.

L. W. RIGGS

Influence of the injection of catalase into the circulation upon the content of different tissues in catalase and in anticalase. L. G. BELKINA, R. N. FALK AND L. L. KREMLEV. *Compt. rend. soc. biol.* 97, 525-6(1927).—Catalase injected into the circulation of rabbits disappears completely in 3 hrs. In the tissues there is at first an increase of catalase, followed by a gradual return to the normal figure in 3 hrs. The largest accumulations of catalase were in the kidney and muscles where it attained a max. in about 1 hr. Variations in anticalase were without regularity except in the liver where it was diminished in the majority of cases.

L. W. RIGGS

Influence of various physiologic and pathologic factors on the functioning of the hematoencephalic barrier. Influence of the para-sympathetic system. L. STERN, A. SLATOWIEROW AND L. BELKINA. *Compt. rend. soc. biol.* 97, 526-7(1927).—The intravenous administration of atropine to rabbits or cats did not diminish the normal resistance of the hematoencephalic barrier to crystalloids, but did diminish its resistance to colloids in some cases. The injection of pilocarpine was without effect on the activity of the barrier toward either crystalloids or colloids.

L. W. RIGGS

External secretion of the pancreas after the injection of decalcifying salts. SADAI-NAZIM AND J. J. BOUCKAERT. *Compt. rend. soc. biol.* 97, 567-70(1927).—Injection of decalcifying salts in dogs does not modify appreciably the external secretion of the pancreas caused by pilocarpine or histamine.

L. W. RIGGS

Action of norhomoephedrine on the isolated heart of the frog and of the snail compared with that of native ephedrine and of β -tetrahydronaphthylamine. (Mlle.) JEANNE LÉVY AND PAUL BOYER. *Compt. rend. soc. biol.* 97, 572-6(1927).—With the perfused frog heart the action of ephedrine and of norhomoephedrine is to diminish the amplitude and frequency, and arrest the heart in diastole. Norhomoephedrine produces the results with much smaller doses. β -Tetrahydronaphthylamine 1 in 1000 arrests the heart in 3 min.; it never increases the amplitude. With the snail heart strong doses of native ephedrine cause immediate arrest in systole. Doses of from 1 in 100 to 1 in 1000 diminish the frequency, increase the amplitude and cause a temporary arrest following 3 or 4 contractions, of which the first has the greatest amplitude. Norhomoephedrine causes the same reactions but more intensely. β -Tetrahydronaphthylamine 1 in 500 arrests the heart in systole in about the same time as norhomoephedrine 1 in 200.

L. W. RIGGS

Sensibility of hypophysectomized dogs to the action of insulin. B. A. HOUSSAY AND M. A. MAGENTA. *Compt. rend. soc. biol.* 97, 596-7(1927).—The hypoglycemia following a dose of insulin is more pronounced, rapid and durable in dogs deprived of the hypophysis.

L. W. RIGGS

Dental and osseous alterations in chronic intoxication by fluorine. CARLOS BERGARA. *Compt. rend. soc. biol.* 97, 600-2(1927).—White rats subjected to prolonged administration of NaF showed a retarded ossification of the connective cartilages and a greater transparency of bones to x-rays. The incisor teeth gradually lose their reddish yellow color, becoming at first more opaque and lighter, then later with dark bands. The superior incisors increase in size and the inferior diminish.

L. W. RIGGS

Diphtheria toxin and adrenaline of the suprarenals. G. MOURMQUAND, A. LEULIER AND P. SEDALLIAN. *Compt. rend.* 184, 1359-60(1927); cf. C. A. 21, 3677.—Diphtheria toxin causes a diminution in the adrenaline content of the suprarenal medulla of the guinea pig; but with animals killed 8-10 hrs. after the injection of the toxin this diminution was observed in only 50% of the cases studied. With animals killed 15-20 hrs. after injection the diminution of adrenaline was general. The diphtheria toxin allows a certain proportion of "virtual" adrenaline to exist, and this quantity becomes very slight when the content of free adrenaline in the fresh capsules is large.

L. W. RIGGS

Vasoconstrictor action of hydrastine. F. MERCIER AND RAYMOND-HAMET. *Compt. rend.* 185, 363-5(1927).—In curarized or unanesthetized dogs, hydrastine (2 mg. per kg.) causes a rise of blood pressure and renal vasoconstriction; in dogs narcotized with chloralose, it causes lowering of blood pressure.

L. W. RIGGS

Proportion of nitrous vapors in the vicinity of an arc lamp used for medical treatment. J. DADLEZ. *Compt. rend.* 185, 420-2(1927).—The analytical method of Kohn-Abrest was used. Irritation was produced by 0.14-0.16 mg. of nitrous vapors per l. of air. A concn. of 0.01 mg. per l. caused no irritation in 30 min. In a space of 50 cu. m. and 50-80 cm. from the lamp, the current passing 2 to 30 min., the quantity of nitrous vapors varied from 0 to 0.15 mg. per l. In a space of 14 cu. m. at a distance of 50-70 cm. from the lamp the nitrous content was 0.17-0.22 mg. per l. The use of the arc lamp

in medical treatment should be accompanied by thorough ventilation of the space near the lamp. L. W. RIGGS

Bromide intoxication. U. J. WILE. *J. Am. Med. Assoc.* **89**, 340-1(1927).—Previous studies have shown that ingested bromide was with difficulty passed through the renal epithelium, consequently bromides tend to become stored in the tissues of the body. Bromide displaces the chloride ion in the body; the ingestion of the former leads to the rapid elimination of the latter, and to chloride deficiency. In cases of bromide intoxication, the intravenous injection of physiologic NaCl soln. leads to the liberation of the bromide from the tissues, occasionally accompanied by a sharp renal irritation. The work reported in the present paper confirms the foregoing conclusions. L. W. R.

The hematopoietic effects of intravenously injected nucleic acids. OLOF LARSELL, N. W. JONES, H. T. NOKES AND B. I. PHILLIPS. *J. Am. Med. Assoc.* **89**, 682-5(1927); cf. *Arch. Path. Lab. Med.* **2**, 698-703(Nov., 1926).—Washed nuclei from the red-blood cells of the fowl, injected into normal rabbits intravenously, produce marked hematopoietic stimulation. The cytoplasm from which the nuclei have been removed does not produce hematopoietic stimulation. Nucleic acids (and nucleoproteins?) obtained from the washed nuclei of the red-blood cells of the fowl, injected intravenously into normal rabbits and into anemic human patients, produce results similar to that resulting from the injection of the nuclei themselves. Injections of Na salts of nucleic acids do not appear to cause deleterious effects in normal rabbits, but in splenectomized rabbits a single injection caused depression and shock, the depression lasting for several days. One human patient splenectomized a year prior to the treatment showed similar effects. How the spleen acts in assimilating injected nucleic acids is not clear. L. W. RIGGS

Pharmacology of concentration changes. II. Mechanism of the adrenalin effect. L. JENDRASSIK AND E. MOSER. *Magyar Orvosi Archivum* **27**, 51-7(1926).—On surviving rabbit intestine, adrenalin given in Tyrode soln. is present in active concn. after the expiration of inhibition. If a new Tyrode soln. is applied to the intestine a transitory irritation follows. Apparently the effects of adrenalin result from concn. changes. **III. Action of the cations.** L. JENDRASSIK AND E. ANNAI. *Ibid* 58-68.—See C. A. **20**, 1860. **IV. Effect of anions.** L. JENDRASSIK AND L. ANTAI. *Ibid* 69-74.—The anions Br⁻, I⁻, SO₄²⁻, NO₃⁻, SCN⁻, F⁻, citrate, oxalate, CO₃²⁻, HCO₃⁻, and HPO₄²⁻ in the form of their Na salts affect rabbit intestine qualitatively in the same way. By an increase of their concns. they produce a transitory irritation, and by a decrease of their concns. a transitory paralysis. By complete or 50% substitution of the NaCl of Tyrode soln. by NaNO₂, NaBr, NaI or Na₂SO₄, the spontaneous movements nearly disappear. With fluoride and salts pptg. Ca, much smaller doses bring about the same results. Change in the content of bicarbonate, that is, the change in the H ion concn., can also cause potential effects. **V. Effects of alcohols and aldehydes on the intestines.** L. JENDRASSIK AND H. TANGL. *Ibid* 75-7.—See C. A. **21**, 454. L. W. R.

Cholagoges. J. SCHAFFLER. *Magyar Orvosi Archivum* **28**, 356-62(1927).—Only drug preps. contg. bile acids or cinchophen promote bile secretion. **Effect of nutrition upon bile secretion.** *Ibid* 363-70.—Neither aromatics nor liquids influence bile secretion. Some carbohydrates promote bile secretion but this is due to accompanying albumin. By increasing the quantity of albumin in the food the bile secretion can be increased up to a max. above which more albumin has no further action. Increasing the no. of meals proportionally increases the bile secretion. Thus 6 albumin-meals per day increase the bile 150%. A quantity of albumin divided and given at intervals is more effective than the same total quantity given at once. **Treatment of liver diseases.** *Ibid* 371-8.—In case of jaundice promotion of the bile secretion is injurious. In liver diseases which are not followed by jaundice, proper diet makes all drugs superfluous. L. W. RIGGS

Role of vitamins and insulin in nutrition. C. FUNK. *Paris Médical* **61**, 389 (1927); *J. Am. Med. Assoc.* **89**, 162; cf. C. A. **21**, 2495.—Substance A (vitamin A) represents the pancreatic hormone. Substance B, or anti-insulin, exerts an action antagonistic to that of insulin. Substance C, or co-insulin, is indispensable for activation of substance A. Unlike insulin substance A is without effect in healthy persons, while in diabetics it reduces the amt. of the blood sugar. In normal conditions the content of substance C in the blood is proportional to that of substance A. Introduction of substance A into the organism causes a surplus which cannot be activated, and consequently remains inert. In the blood of diabetic persons substance A is deficient, while the amt. of substance C is greatly increased. The fact that substance A reduces the blood sugar in diabetics is thus explained. Substance A does not cause hydermia or hypoglycemic shock which are sometimes observed with insulin. In rabbits substance B induced hyperglucemia accompanied by pancreatic disturbances. The animals lost

wt. and developed hydremia and grave anemia. Substances *A* and *B* are present in the pancreas and in the liver, and are found in almost all alimentary products. Cf. following abstr. L. W. RIGGS

Use of substance *A* of insulin in diabetic patients with cardiac lesions. C. FUNK. *Progrès Médical* 54, 245(1927); *J. Am. Med. Assoc.* 89, 163.—Isolated substance *A* may not be of much therapeutic importance in diabetes, until it becomes possible to isolate the activating substance *C*. But in diabetic patients with cardiac lesions, who do not tolerate insulin, substance *A*, which is c. p. and is atoxic, can be advantageously used. L. W. RIGGS

Toxicology of carbon monoxide. D. I. MACHT. *Science* 66, 198-9(1927).—Growth of roots from seeds of *Lupinus albus* is retarded by co-hemoglobin. L. W. R.

Action of tetrodon poison. SHIGETARO KIMURA. *Tôhoku J. Exptl. Med.* 9, 41-65 (1927).—*Tetrodon* poison or tetrodotoxin is derived from the ovary of the hedge-hog fish. It loses its poisoning power rather rapidly in the animal body by being either fixed or decompd. It is not eliminated by the kidneys. The blood serum, because of its alk., participates in the detoxication. Probably some other mechanism for detoxication takes place in the animal body. L. W. RIGGS

Comparative studies of pharmaceutical preparations of the digitalis group. KESUKE YAMANOUCHI. *Tôhoku J. Exptl. Med.* 9, 111-28(1927).—Prepns., made from the following 6 crude drugs belonging to the digitalis group so as to contain as much active but as little useless substances as possible, were compared with each other with regard to the intensity of their various actions, the same heart active dose or concn. being used. In the following table, which shows the relative intensity of the actions by taking the intensity of the actions of digitalis prepns., as 100, column I has the figures for local irritant action, II emetic action, III absorption from small intestine, IV absorption from cutaneous tissues, V persistency of cardiac action, and VI action on vagus center.

Preparation	I	II	III	IV	V	VI
Digitalis	100	100	100	100	100	100
Strophanthus	20	76	168	127	14	300
Convallaria	33	52	57	110	20	250
Scilla	100	48	53	72	20	88
Adonis	100	71	125	106	14	150
Rhodea	33	54	75	94	60	167

L. W. RIGGS

Effect of intravenously administered adrenaline upon the epinephrine output from the suprarenal body. TADASHI SUGAWARA, SHIZUKA SAITO AND MAMORU NEMOTO. *Tôhoku J. Exptl. Med.* 9, 149-206(1927).—Twenty-eight pp. of tables show that injected adrenaline in dogs and cats does not increase the epinephrine discharge from the suprarenal gland. L. W. RIGGS*

Influence of different drugs on the physiological reactions resulting from progressive oxygen dilution. II. Drugs which act on the central nervous system. RYŪZŌ YOSOMIYA. *Tôhoku J. Exptl. Med.* 9, 207-28(1927); cf. *C. A.* 21, 2739.—Under increased O diln. the rate of O absorption is decreased by morphine, urethan, luminal, veronal and antipyrine, and by morphine, luminal and veronal the O content of arterial blood is still more reduced to correspond with the decrease of O in the inspired air, while antipyrine and urethan show a tendency to retard and diminish this reduction. **III. Influence of inner secretions and vegetative nerve poisons.** *Ibid* 229-50.—The rate of O absorption increases after the administration of adrenaline and atropine, but generally decreases after pituitrin, pilocarpine and insulin. Many other physiol. reactions of these agents, and of the drugs mentioned above, are illustrated with graphs and are described in detail. L. W. RIGGS

Effect of strychnine on the rate of epinephrine output from the suprarenal glands of dogs. MASANOSUKÉ WATANABÉ. *Tôhoku J. Exptl. Med.* 9, 251-73(1927).—The rate of epinephrine liberation was detd. on the etherized dogs by means of the cava pocket method and the rabbit intestine segment method. Aq. solns. of strychnine sulfate or nitrate were generally administered intravenously, occasionally hypodermically. Small doses, less than 0.2 mg. per kg., and large doses of more than 4.0 mg. per kg., that is, the paralytic dose, were ineffective in causing an increased liberation of epinephrine from the suprarenal glands. Moderate doses of 0.25-3.0 mg. per kg. were invariably capable of causing an increased output of epinephrine, in some instances of 4-5 times the initial rate. About 10-20 min. after the administration the highest rate due to strychnine poisoning usually occurred and the increased discharge continued 20-40 min. after the

injection or longer. The occurrence of the augmentation depends on the integrity of the splanchnic nerves.

"Synthalin." P. IVERSEN AND J. MUNCK. *Ugeskrift for Laeger* 89, 533(1927); *J. Am. Med. Assoc.* 89, 924.—Overdoses of synthalin are poisonous. Together with the toxic effect it has a characteristic effect on the carbohydrate metabolism. The prepn. may have a limited value in the d'nic when insulin treatment is at an end. L. W. RIGGS

"Synthalin" treatment of diabetes mellitus. J. H. HOLST. *Ugeskrift for Laeger* 89, 540(1927); *J. Am. Med. Assoc.* 89, 924.—The individual tolerance for synthalin is variable and the effect on the blood sugar varies in different patients. It may have but slight effect with patients having a high glucosuria. It appears to be most effective in patients in whom the blood sugar concn varied widely during treatment with insulin. A positive or const. effect from the treatment was not seen in grave diabetes with marked hyperglucemia, glucosuria and acidosis. In such cases the hyperglucemia and acidosis should be reduced by diet before synthalin treatment is started. In transferring patients from even small doses of insulin to synthalin both should at first be given and the insulin reduced gradually if the synthalin proves effective. L. W. RIGGS

Physiological importance of glutathione. (MRS.) LUCIE RANDOIN. *Bull. soc. hyg. aliment* 15, 245-9(1927). A discussion of the properties of glutathione shows the possibility of its intervention in org. oxido-reductions, since it has been found that under phys. conditions which can occur *in vivo* it can transport O to substances of known biol. importance. R. considers that glutathione in particular, and compds. contg. an SH group in general, act on certain special products of basal cellular metabolism rather than in general metabolic processes

A. PAPINEAU-COUTURE

Treatment of bubonic plague by intravenous injections of colloidal iodine. C. GRIMES. *Bull. soc. pathol. exot* 19, 584(1926); *Colloides biol. clin. therap* 1, 41(1927).

A. PAPINEAU-COUTURE

The biological activity of colloids. B. G. DUHAMEL AND R. THIEULIN. *Colloides biol. clin. therap.* 1, 17-32, 61-71(1927).—The true therapeutic activity of inorg. colloids seems to be out of proportion with the importance of the phenomena observed in lab. expts. From expts. on so-called "colloidal shock," D. and T. conclude that: (1) The distribution in the organism of inorg. colloids injected intravenously suggests that the liver, blood and spleen participate in the biol. activity of these colloids (2) The phenomena of "colloidal shock" comprise a *hepatic shock* and a *hematic shock* (3) The hepatic shock is the manifestation of a complex defensive reaction starting in the liver, where the greater portion of the injected colloid rapidly assembles. (4) The study of autolyzed liver exts shows that, during colloidal shock, this organ acquires strong toxolytic properties (tested *in vitro* and *in vivo* on the toxins of *B. pyocyaneus*, *B. diphtheriae* and streptococcus). (5) These modifications of the toxolytic power of the liver coincide with a glycogenetic superactivity. (6) The hematic shock is characterized by a modification of the no., quantity and resistance of the leucocytes, and by humoral modifications comprising an increase in the agglutinative and opsonizing functions. (7) The increase of the agglutinative power of the serum during the colloidal shock is const. only in the case of colloids having a given elec. sign. The immediate sp. activity of colloids therefore seems to depend on the nature of their elec. charge. (8) The phagocytic coeff. increases during colloidal shock, this modification depending essentially on the opsonizing properties of the serum. (9) The hematic shock is mainly a humoral crisis, and apparently is subordinate to the hepatic shock. The greater part of the activity of colloids therefore depends on the liver.

A. P.-C.

Animal poisons. ANGELO CONTARDI AND PIA LATZER. *Giorn. chim. ind. applicata* 9, 55-62(1926).—Monograph on the properties of some animal poisons.

ROBERT S. POSMONTIER

The effects of guanidine compounds on the blood pressure when introduced slowly into the circulation and into the gastrointestinal tract. R. H. MAJOR. *Bull. Johns Hopkins Hosp.* 39, 215-21(1926).—No elevation of blood pressure results after the introduction of methylguanidine sulfate. It is absorbed from the gastrointestinal tract, largely from the ileum and much less from the stomach, duodenum, jejunum and colon.

G. F. REDDISH

Insulin treatment of undernutrition in nondiabetic subjects. R. FEISSLY. *Presse Méd.* 34, 196-9(1926).—Improvement was noted.

G. F. REDDISH

Cell poisoning by carbon monoxide. Annotation. ANON. *Lancet* 1927, I, 666.—The observations by J. B. S. Haldane (*Nature*) are discussed, namely, that motion in the wax moth and cress ceases when the O reaches 8.8% and CO 91%. On admitting air there is recovery in the moth in contrast to the effect on hemoglobin. The blood

of 29 out of 42 workers in garages in New York, who had no clinical symptoms, gave evidence of CO poisoning. F. B. SEIBERT

The peristaltic and antiperistaltic movements of segments of excised pig ureters as affected by drugs. C. M. GRUBER. *J. Pharmacol., Proc.* 31, 202-3(1927).—The effects of adrenaline, urea, nicotine, acetylcholine, atropine, pituitrin and Na phenobarbital were studied. GEORGE ERIC SIMPSON

Studies of the respiratory reflex effects of ether. II. In relation to urinary secretion. M. S. DOOLEY AND CHARLES J. WELLS. *J. Pharmacol., Proc.* 31, 204 (1927).—Ether (and other strongly irritant anesthetics in less degree) applied only to the upper part of the respiratory tract caused anuria. This is shown to be due to local irritation. GEORGE ERIC SIMPSON

Effect of potassium iodide on bronchoconstriction. A. D. HIRSCHFELDER AND GEORGE WILKINSON. *J. Pharmacol., Proc.* 31, 205(1927).—When 5 to 7 cc. of isotonic or hypertonic KI soln was injected into decerebrate guinea pigs previously treated with pilocarpine-HCl bronchodilation occurred. KCl was not so effective. Isotonic NaCl had no effect, but hypertonic solns. did. GEORGE ERIC SIMPSON

The action of indole and skatole on the heart. J. A. WADDELL. *J. Pharmacol., Proc.* 31, 205-6(1927).—They are depressant. GEORGE ERIC SIMPSON

The influence of the C_{10} of the blood on the reaction of the heart to drugs. WILLIAM SALANT AND J. E. NADLER. *J. Pharmacol., Proc.* 31, 206-7(1927).—The toxicity of *Hg succinate* and *cocaine* to the exposed heart of cats was increased following injection of acid and decreased after Na_2CO_3 . NaH_2PO_4 injections decreased the effectiveness of strophanthin. In the later stages of strophanthin poisoning, KH_2PO_4 had the opposite effect. GEORGE ERIC SIMPSON

Methemoglobinemia. T. K. KRUSE, W. S. McELROY AND C. C. GUTHRIE. *J. Pharmacol., Proc.* 31, 208-9(1927).—Methemoglobinemia was produced in dogs by oral administration of acetanilide. Except with large dogs, it did not last after 24 hrs.; there was a reversion to active hemoglobin. The methemoglobin of drawn blood changed to active hemoglobin on standing at room temp. Hemolyzed blood did not exhibit this reversal. GEORGE ERIC SIMPSON

The antagonism between quinine or quinidine and epinephrine. ERWIN E. NELSON. *J. Pharmacol., Proc.* 31, 209-10(1927). GEORGE ERIC SIMPSON

Blood sugar in dogs during morphine tolerance and withdrawal. I. H. PIERCE AND O. H. PLANT. *J. Pharmacol., Proc.* 31, 210(1927).—The blood sugar curve showed (a) abrupt rise after the beginning of the dosage; (b) generally elevated level in early stages of tolerance; (c) generally lowered level later in tolerance; (d) abrupt rise after withdrawal, followed by a return to normal. GEORGE ERIC SIMPSON

General symptoms and behavior of dogs during morphine tolerance and withdrawal. O. H. PLANT AND I. H. PIERCE. *J. Pharmacol., Proc.* 31, 210-1(1927). GEORGE ERIC SIMPSON

Excretion of morphine during gradually produced and prolonged tolerance to morphine in dogs (preliminary report). I. H. PIERCE AND O. H. PLANT. *J. Pharmacol., Proc.* 31, 212(1927); cf. preceding abstracts.—Less than 30% of the morphine was recovered. When the dosage was high (50 mg. per kg.) only 2-8% was recovered. More was found in the urine than in the feces. GEORGE ERIC SIMPSON

Effect of ephedrine on intestinal contractions in unanesthetized dogs. J. H. KINNAMAN AND O. H. PLANT. *J. Pharmacol., Proc.* 31, 212-3(1927). G. E. S.

Further observations in experimental chronic morphinism. A. L. TATUM, K. H. COLLINS AND M. H. SEEVERS. *J. Pharmacol., Proc.* 31, 213-4(1927); cf. C. A. 20, 3042.—New expts. support the previously advanced view of addiction and tolerance. GEORGE ERIC SIMPSON

Effect of salicylates on the nitrogen metabolism. G. P. GRABFIELD AND EMILY KNAPP. *J. Pharmacol., Proc.* 31, 215-6(1927).—The increase in N elimination occurred immediately after Na salicylate was given, later after Li salicylate, and delayed after K salicylate. The Li salt caused an extremely prompt increase in uric acid excretion; with Na and K salts this occurred later. An increase in total S, chiefly due to inorg. SO_4 , paralleled the increase in N. GEORGE ERIC SIMPSON

The effect of sodium thiosulfate on arsenic elimination. A. G. YOUNG. *J. Pharmacol., Proc.* 31, 217(1927).—In 2 cases of As intoxication and 4 cases undergoing anti-syphilitic treatment but without intoxication, the excretion of As and urine vol. was followed for five days following 1 injection of neoarsphenamine. The following week $Na_2S_2O_3$ was given daily following the injection. In rabbits the effect of $Na_2S_2O_3$ in As poisoning on the excretion of As, duration of life, and the production of gross kidney lesions was detd. $Na_2S_2O_3$ decreased the rate of As excretion, and increased the

tolerance for repeated sublethal doses. With it, kidney lesions were less marked. The $\text{Na}_2\text{S}_2\text{O}_3$ may form an insol. compd. with As. GEORGE ERIC SIMPSON

The toxicity and trypanocidal activity in rats of a group of new unsymmetrical arseno compounds. W. K. STRATMAN-THOMAS AND A. S. LOEVENHART. *J. Pharmacol., Proc.* 31, 217-9 (1927).—The lethal dose, the max. tolerated dose and the dose which protected rats infected with *Trypanosoma brucei* were detd. for the following arsenobenzenes: *p*- $\text{HOOC}_6\text{H}_4\text{As}_2\text{C}_6\text{H}_4\text{NHCH}_2\text{CH}_2\text{OH}\cdot\text{HCl}\cdot\text{p}$, *p*- $\text{HOSOCH}_2\text{HNC}_6\text{H}_4\text{As}_2\text{C}_6\text{H}_4\text{NHCH}_2\text{CH}_2\text{OH}\cdot\text{p}$, 3,4- $\text{HCl}\cdot\text{H}_2\text{N}(\text{HO})\text{C}_6\text{H}_4\text{As}_2\text{C}_6\text{H}_4\text{NHCH}_2\text{CH}_2\text{OH}\cdot\text{HCl}\cdot\text{p}$, *p*- $\text{HOOC}_6\text{H}_4\text{As}_2\text{C}_6\text{H}_4\text{NHCH}_2\text{CONH}_2\cdot\text{HCl}\cdot\text{p}$, 3,4- $\text{HCl}\cdot\text{H}_2\text{N}(\text{HO})\text{C}_6\text{H}_4\text{As}_2\text{C}_6\text{H}_4\text{NHCH}_2\text{CONH}_2\cdot\text{HCl}\cdot\text{p}$.

GEORGE ERIC SIMPSON

The gaseous metabolism of the rain as influenced by various procedures, including certain drugs. C. F. SCHMIDT AND H. B. HAAG. *J. Pharmacol., Proc.* 31, 219-20 (1927); cf. *C. A.* 19, 1598.—Gaseous metabolism of the brain stem increased when respiration was stimulated, and decreased when it was depressed. Elec. stimulation, puncture of the medulla, morphine, atropine, caffeine, ether, ephedrine, adrenaline, and cyanides were used. CO_2 was also used. CO_2 usually decreased the apparent O_2 consumption and CO_2 production of the brain stem; this is perhaps because CO_2 dilates cerebral vessels markedly.

GEORGE ERIC SIMPSON

An application of the thermal conductivity method for the analysis of gases to pharmacological problems. B. H. ROBBINS AND P. D. LAMSON. *J. Pharmacol., Proc.* 31, 220 (1927).—The app. of Palmer and Weaver (*C. A.* 18, 1099) was applied to the detn. of CCl_4 in air.

GEORGE ERIC SIMPSON

The pharmacology of certain vasomotor reactions. D. E. JACKSON. *J. Pharmacol., Proc.* 31, 220-1 (1927).—Vaso-constriction in nasal mucous membranes and accessory nasal sinuses occurred when adrenaline, ephedrine, β -tetrahydronaphthylamine-HCl, pituitrin or Ba were injected into a femoral vein. Deep Et_2O or $\text{CH}=\text{CH}$ anesthesia, and CO_2 caused vaso-dilatation.

GEORGE ERIC SIMPSON

Excretion studies in experimental nephritis. ADOLPH BOLLIGER. *J. Pharmacol., Proc.* 31, 221-2 (1927).—After deep x-ray had produced chronic interstitial nephritis in dogs, phenolsulfonephthalein, acid fuchsin, Buffalo fast crimson, uranin, indigo carmin, $\text{Na}_2\text{S}_2\text{O}_3$ and Na_3PO_4 (?), injected intravenously, showed the same excretion curves. The NaI curve was irregular during different stages of the nephritis. The output of $\text{Na}_2\text{S}_2\text{O}_3$ and NaI was depressed during gestation. "Acid fuchsin, uranin, $\text{Na}_2\text{S}_2\text{O}_3$ and Na_3PO_4 (?) may indicate more definitely early kidney lesions than the phenolsulfonephthalein test."

GEORGE ERIC SIMPSON

Action of some expectorants. W. L. MENDENHALL AND MILDRED CATE. *J. Pharmacol., Proc.* 31, 222 (1927).—Weak concns. of expectorants applied to oyster cilia previously paralyzed with ACh in Et_2O stimulated markedly. NH_4Cl , HI and KI were depressant in higher concns.

GEORGE ERIC SIMPSON

Action of barium chloride. H. A. MCGUIGAN AND H. N. ETS. *J. Pharmacol., Proc.* 31, 223-4 (1927).—The results indicate that at least some of the toxicity of BaCl_2 placed in intestinal loops was due to the removal of Ca in the tissues. When BaS was spread on the ears of rabbits, sulfide, but not Ba, was found in the tissues of the animals, who died, probably from sulfide poisoning. CaS and K_2S were not as toxic as BaS .

GEORGE ERIC SIMPSON

Some observations on the pharmacology of tin. F. W. SCHWARTZ AND W. F. CLARKE. *J. Pharmacol., Proc.* 31, 224-5 (1927).—The amts. of Sn or Sn compds. fed to animals were not harmful. When men were fed 2 to 2.75 g. Sn in 5 days, only slight amts. of SnO were found in the urine.

GEORGE ERIC SIMPSON

Bromine excretion following bromoform anesthesia. G. H. W. LUCAS, W. E. BROWN AND V. E. HENDERSON. *J. Pharmacol., Proc.* 31, 225 (1927).—After anesthesia with CHBr_3 , $\text{C}_2\text{H}_5\text{Br}$ and $\text{CH}_2\text{Br}\cdot\text{CH}_2\text{Br}$, Br was excreted in the urine. G. E. S.

Myographic studies of picrotoxin convulsions. MCKEEN CATTELL. *J. Pharmacol., Proc.* 31, 227 (1927).

GEORGE ERIC SIMPSON

A clinical standardization of digitalis. I. F. MARTIN. *J. Pharmacol.* 31, 229-45 (1927); cf. following abstr.—Samples of digitalis prepd. by Magnus for the Hygiene Committee of the League of Nations were used in this work and in that reported in the following abstr. Each sample was used on 6 or 7 different cases of myocardial insufficiency. The criteria of clinical improvement included improved respiration, clearing of congested lung bases, diuresis, etc., as well as slowing of cardiac rate. The relative potencies were A 76%, B 141%, of C. Biol. assay in other labs. is reported as giving: A 62%, B 116%, of C (report on standardization of digitalis to Hygiene Committee of the League of Nations. E. KNAFFL-LENZ. Personal communication to Martin.)

GEORGE ERIC SIMPSON

The clinical comparison of three preparations of digitalis. A. R. GILCHRIST AND D. M. LYON. *J. Pharmacol.* 31, 319-32(1927); cf. preceding abstr.—The digitalis preps. were ostensibly the same as those used by Martin. They were given to 122 subjects, mostly fibrillators, but also to non-fibrillators and non-cardiac cases. With the 2 latter groups inconstant results were obtained. The criterion of therapeutic effect was slowing of the heart rate. The relative strengths as detd. with fibrillators were A 64%, B 89%, of C, which compares favorably with results obtained by Joachimglu. Biol. assay in other labs. is reported as giving: A 38-88, av. 60%; B 70-145, av. 100%, of C (Knaff-Lenz, *C. A.* 21, 301).

The effect of insulin on hypophysectomized dogs. F. M. K. GETLING, D. CAMPBELL AND Y. ISHIKAWA. *J. Pharmacol.* 31, 247-68(1927).—The hormone of the posterior lobe of the hypophysis is antagonistic to the action of insulin. This is shown by the following evidence: (a) Hypophysectomized dogs (2) showed an increased sensitivity to insulin. (b) This sensitivity increased progressively in the course of weeks after the operation, in 3 instances. (c) Dogs with the stalk either removed or constricted with a silver clip also exhibited this sensitivity. (d) When posterior lobe ext. was injected simultaneously with a quantity of insulin otherwise sufficient to produce convulsions in 2 hypophysectomized dogs, convulsions were not produced, although blood sugar decreased. (e) This effect was not exhibited by anterior lobe ext. nor, in a single expt. did increased sensitivity follow removal of the anterior lobe. "The exact mechanism of the antagonistic action of the pituitary gland and the thyroid to insulin is not clear." The progressively increasing sensitivity of hypophysectomized dogs is probably explained by the atrophy of some of the ductless glands whose hormones are antagonistic to insulin.

The anesthetic value of nitrous oxide under pressure. W. E. BROWN, G. H. W. LUCAS AND V. E. HENDERSON. *J. Pharmacol.* 31, 269-89(1927).—For producing anesthesia with N_2O , anoxemia is necessary. To show this, 20 expts. were performed with rabbits and cats, using mixts. of 5 to 21% O_2 in N_2O , at 1 to 2 atm. pressure. Anesthesia (i. e., lack of response to elec. stimulation) was produced only when the partial pressure of O was 70 mm. or less.

The electromotive action of drugs as a cause of their toxicity. I. The extension of Nernst's theory of excitation and the experimental demonstration of the sensitivity of a certain phase boundary potential towards potent alkaloids. R. BEUTNER. *J. Pharmacol.* 31, 305-18(1927).—The system $Hg|KCl|KCl$ in satd. $HgCl|10\%$ oleic acid in nitrobenzene $|0.02\%$ Na oleate in physiol. $NaCl|KCl$ in satd. $HgCl|Hg$ was set up. The oleate- $NaCl$ soln. was contained in a beaker; addn. of 0.2, 1.0, 2.0, 4.0 mg. pilocarpine per 100 cc. of this soln. caused a lowering of the e. m. f. of the system by 11, 33, 43 and 57 millivolts. Strychnine sulfate, cocaine-HCl, epinephrine and other drugs were used in similar expts. "A change of the p. d. is brought about also somewhere inside the tissues, resembling to some extent that in the artificial system."

The toxicity of drugs after hemorrhage. HARRY GOLD. *J. Pharmacol.* 31, 291-303 (1927).—"The diminished vol. of circulating fluid [produced by removal of 50% of the blood] is an important factor in the causation of increased susceptibility [of cats to strychnine, physostigmine, chloral hydrate and ouabain] not by reason of the greater concn. of the drug in the blood stream, but because the vol. of blood controls... the distribution of blood to various organs of the body." The increased susceptibility was found with all 4 drugs. Its possible cause was detd. by expts. with strychnine: (a) Normal tolerance may return in 2 hrs. with blood pressure still low. It returns simultaneously with partial restoration of blood vol. (b) Retaining normal blood pressure by means of epinephrine did not secure normal tolerance. (c) It was restored temporarily by replacing the blood with Locke's soln. (d) Reduction of the alk. reserve did not affect tolerance.

Action of domesticin-methyl ether upon the peripheral nerves. T. SHIINA. *J. Pharm. Soc. Japan* No. 544, 529-32(1927).—An answer to the criticism of S.'s work (*Z. med. Gesellsch. Chiba* 4, No. 5) by Takase and Ohashi (*C. A.* 21, 2336). NAO UYEH

Further observations on the anti-diabetic properties of Tecoma mollis. G. G. COLIN. *J. Am. Pharm. Assoc.* 16, 199-203(1927); cf. *C. A.* 21, 777.—After several trials with animals with artificial diabetes (phlorizin) it was concluded that the drug had no effect under those conditions. The drug is not toxic to animals. It may be used over a long period of time without harmful effects, in man. As a general tonic it may occupy a prominent place in rational therapeutics. Although its action has not been well defined, its effects are well proved. Seven diabetic patients were treated. In all cases thirst was diminished and consequently the 24-hr. vol. of urine decreased. In no case did the decrease in vol. of urine correspond to a proportionate rise in glucose

concn., diabetic factors remaining const. Some patients stated that they had felt aphrodisiac effects. These patients were over 60 yrs. of age, male. A remarkable increase in appetite was manifested by several patients (the ext. has an intensely bitter taste). One patient who had been under insulin treatment previously refused to continue the treatment, because the increase in appetite interfered with his dietetic habits. This effect is not permanent. It is felt only during 3 or 4 days at the beginning of the treatment. It is impossible to state in definite percentages the no. of those benefited and of the negative cases. Outside patients usually discontinue the treatment at the first signs of improvement. Although the glucosuria persists, the general health of the patient is improved. In a no. of cases the results were absolutely negative, in every respect. Although the use of *Tecoma mollis* benefits some types of diabetic patients, it has not been defined what types of diabetes it is best suited for. The fact that some old patients have felt aphrodisiac stimulation may point out its properties as a general tonic. It has been believed that *Tecoma mollis* is a diuretic, but facts seem to point to the contrary. The action of the drug is antidiuretic and it seems likely that there may be a possible stimulation to pituitary secretion by the use of the ext. L. E. WARREN

Some observations on digitalis action. ALBERT SCHNEIDER. *J. Am. Pharm. Assoc.* 16, 614-6(1927).—Each of 72 individuals was given 0.1 cc. of infusion of digitalis per kg. of body wt. and the pulse rate observed 30 min. later, and also at succeeding intervals of 10 min. for an hr. or more. In one series Ca lactate was also given. The results indicate that Ca increases and stabilizes digitalis action. Age modifies digitalis action. Persons with age ranges from 19 to 21 yrs. showed an av. pulse rate reduction of 11.4%, whereas those with an age range from 28 to 30 yrs. showed an av. reduction of 8.94%. Variation in body wt. apparently does not markedly modify pulse rate reduction due to digitalis action, at least not when the dosage is according to body wt. The av. % rate reduction for wts. from 135 to 160 lbs. was 9.3%. A small percentage of persons apparently show an increase in pulse rate following digitalis administration, even when combined with Ca. The limited no. of observations made would indicate that digitalis does not influence an irregular heart. The tests indicate that the pulse rate would serve as a guide to the therapeutic action of digitalis in cardiac cases, and also as a guide to dosage. Well dried and well kept digitalis leaf does not lose much more than 8-10% of its action within 1 yr. This has been verified in other samples of digitalis. However, badly kept and badly cured leaf loses its strength rapidly. A full strength infusion of digitalis leaf, when given in doses of 0.1 cc. per kg. of body wt., should cause an av. percentage reduction in pulse rate of 10. There is, however, considerable individual variation in the rate of reduction. L. E. WARREN

Further studies on the physiologic action of propylene. LLOYD K. RIGGS AND HAROLD D. GOULDEN. *J. Am. Pharm. Assoc.* 16, 635-9(1927).—Continuation (C. A. 19, 3122). The results tend to confirm the previous observation that the primary toxic action of propylene is upon the respiratory center and only secondarily on the heart. In one animal the respiration and heart failed simultaneously. Periods of muscular rigidity occurred in some of the animals accompanied by a contraction of the oculomotor muscles, thus causing a stare. Old, stored propylene caused these symptoms more frequently than the recently prepd. uncompressed anesthetic. L. E. WARREN

The influence of digitalis on the resistance of guinea pigs to poisoning by diphtheria toxin. C. C. HASKELL. *J. Am. Pharm. Assoc.* 16, 639-44(1927).—It has been stated that digitalis is contraindicated in diphtheria and other infections. In the expts. reported on, diphtheria was selected for the tests and it was found that the administration of tincture of digitalis, apparently, does not hasten the death of guinea pigs that were coincidentally given a dose of diphtheria toxin. L. E. WARREN

Influence of kidney irritants on the gaseous metabolism of kidney. HIRONORI KABURAKI. *Proc. Imp. Acad. (Japan)* 3, 474-5(1927).—Such kidney irritants as sandalwood oil and turpentine oil augment the O consumption by affecting the kidney cells, but this irritation does not necessarily accompany diuresis. C. J. WEST

Ethylene vs. nitrous oxide: A statistical study of the circulation. L. F. SISE. *Anesthesia and Analgesia* 6, 17-20(1927). R. C. WILLSON

The true anesthetic value of nitrous oxide. V. E. HENDERSON, W. EASON BROWN AND G. H. W. LUCAS. *Anesthesia and Analgesia* 6, 21-4(1927).—Rabbits were subjected to N₂O-O₂ mixts. under pressure. Contrary to Paul Bert, it was found that anesthesia (lack of response to elec. stimulation) was not produced as long as the O₂ concn. was as great as in air. R. C. WILLSON

Experiences with carbon dioxide in hiccough. R. F. SHELDON. *Anesthesia and Analgesia* 6, 31-34(1927). R. C. WILLSON

Oxygen therapy in pneumonia. J. H. EVANS. *Anesthesia and Analgesia* 6, 57-62 (1927). R. C. WILLSON

Oxygen therapy by means of compressed air. O. J. CUNNINGHAM. *Anesthesia and Analgesia* 6, 64-66 (1927). R. C. WILLSON

Propylene, ethylene, nitrous oxide and ether: Some comparative investigations. CHAPMAN REYNOLDS. *Anesthesia and Analgesia* 6, 121-4 (1927); cf. *C. A.* 20, 1870.—In mixts. in which the partial pressure due to propylene was 35% and that due to O₂ 20%, frog hearts *in situ* survived for an av. of 332 min. while in ethylene 90% and O₂ 20% mixts. the av. survival time was 287 min. Isolated turtle hearts which survived in air for an av. time of 272 min. survived (av.) for 205 and 225 min., resp., in propylene 35%-O₂ 20% and ethylene 90%-O₂ 20%. The min. anesthetic and minimal lethal concns. for white mice were, resp., propylene, 40 and 65% gas; ethylene, 90 and 146% gas; N₂O 90 and 270% gas. Electrocardiographic observations on dogs showed that propylene in concns. above 25% and below anesthetizing concns. caused ectopic ventricular contractions. Ectopics were not observed in control studies with ethylene, N₂O, Et₂O and CHCl₃. R. C. WILLSON

The effects of acetaldehyde, ether peroxide, ethyl mercaptan, ethyl sulfide and several ketones—dimethyl, ethylmethyl and diethyl—when added to anesthetic ether. WESLEY BOURNE. *Anesthesia and Analgesia* 6, 131-10 (1927); see *C. A.* 20, 3747. R. C. WILLSON

Further observations on the use of barbital as a preventative of cocaine toxicosis. JOHN LESHURE. *Anesthesia and Analgesia* 6, 189-90 (1927).—Doses of 0.4 to 0.8 g. of sodium barbital orally at least 30 min. before the induction of cocaine analgesia will prevent symptoms of cocaine toxicosis in practically every case. R. C. WILLSON

The duration of the life of the *Spirochaeta pallida* under the influence of bismuth treatment. S. V. SZENTKIRÁLYI. *Dermatol. Wochschr.* 84, 22-4 (1927).—The curve of the duration of life during neoarsphenamine treatment falls sharply in 24 hrs., while during Hg treatment days or even weeks are required before the curve reaches zero. The curve for neobismosalvan (iodine-quinine-bismuth 50%, lecithin 50%) falls slowly during the first 24 hrs. and sharply thereafter. R. C. WILLSON

The effect of neoarsphenamine on the formation of immune bodies. M. MELCZER AND O. DAHMEN. *Dermatol. Wochschr.* 84, 581-7 (1927).—Neoarsphenamine administered intravenously has only an etiotropic action. However, in cases of manifest syphilis with febrile reactions, the icetus immunisatorius plays a certain role. R. C. WILLSON

Two years' observation of the fundus oculi in tryparsamide treatment of general focal or paralysis of the insane. J. H. ROTH. *Ill. Med. J.* 51, 242-5 (1927). R. C. W.

Treatment of metallic poisoning with sodium thiosulfate. D. W. GOLDSTEIN. *J. Ark. Med. Soc.* 23, 133-4 (1927).—The use of Na₂S₂O₃ (0.6-1.0 g.) intravenously soon after the ingestion of the drug effected a rapid cure without the usual distressing symptoms in 4 cases of HgCl₂ poisoning, 1 of acute As poisoning and 1 of chronic As poisoning. R. C. WILLSON

Red urine. J. A. MEASE, JR. *J. Fla. Med. Assocn.* 13, 291-2 (1927).—Report of the case of a 5-year old child who after eating a large quantity of red beets (*Beta vulgaris*) excreted brilliant red urine. The abnormal color disappeared within 24 hrs. and was attributed to the anthocyanins in the beets. Subsequent feeding of a quantity of beets produced the same results. R. C. WILLSON

Relation of white snakeroot to human milk sickness. A. A. HANSEN. *J. Indiana State Med. Assocn.* 20, 182-7 (1927).—White snakeroot (*Eupatorium urticaefolium*) contains a complex alc. called *trematol*, a resinous acid and a volatile oil. Milk sickness in man is caused by the use of milk from cows which have grazed on white snakeroot. R. C. WILLSON

Five recent cases of shoe dye poisoning. HENRY ALBERT AND JAMES WALLACE. *J. Iowa State Med. Soc.* 17, 225-7 (1927).—In each case typical poisoning corresponding to that due to aniline or nitrobenzene developed soon after wearing shoes that had been dyed within 36 hrs. No fatal cases. R. C. WILLSON

The diuretic action of urea and high protein diets. S. E. KING. *Med. Clinics of N. Am.* 10, 963-78 (1927). R. C. WILLSON

Results of the long-continued use of insulin in diabetes. J. R. WILLIAMS. *N. Y. State J. Med.* 27, 49-50 (1927). R. C. WILLSON

Arsenic findings in dermatological conditions. BINFORD THORNE, L. S. VAN DYCK, ELEANOR MERPLES and C. N. MYERS. *N. Y. State J. of Med.* 27, 757-63 (1927).—Arsenic was found in pathol. amts. in the urine in eczema, scleroderma, leucoderma, psoriasis, Majocchi's disease, pemphigus, motor ocular paralysis and pigmentation.

In some cases of eczema it appears to be the exciting cause, producing symptoms immediately after contact; in other it appears to be deposited in the skin sensitizing it and causing a reaction when the person is exposed to a banal irritant. In scleroderma it appears that As attacks the vegetative nervous system and later perhaps the endocrine system. In a case of motor-ocular paralysis the As had combined with the SH radical of the nerve tissue, thus altering the nerve function. In leucoderma the affinity of As for pigment caused deposition in the pigmented region adjacent to the depigmented spots. It appears that food contamination and occupational contact are the most frequent sources of As poisoning.

R. C. WILLSON

Calcium metabolism and the parathyroid glands. C. F. DAVIDSON. *Northwest Med.* 26, 181-6(1927).—A review.

R. C. WILLSON

The use of insulin in the treatment of certain nondiabetic conditions of infancy and childhood. V. W. SPICKARD. *Northwest Med.* 26, 282-4(1927).—Insulin was found beneficial in alimentary intoxication, acidosis and acute infections with great dehydration.

R. C. WILLSON

A new iodine compound for cholecystography. B. R. KIRKLIN. *Radiology* 9, 205-8(1927).—Diiodoethyl ether of disalicylphthalein was prepd. to be used in place of tetrabromo- or tetraiodophenolphthalein in x-ray examn. of the gall bladder, since the latter sometimes causes nausea, vomiting and purging and shows poor absorption. Limited experience with the new compd. indicates superiority over the compds. formerly used, in that shadows of deeper density are produced and there is no nausea after ingestion of it. Slight purgative effects in a few cases were attributed to impurities in the prepn.

R. C. WILLSON

Ergot preparations. A. STOLL AND E. ROTHLIN. *Schweiz. med. Wochschr.* 57, 106-10(1927).—To ergotamine is due most of the sp. action of ergot. Ergotamine is important in view of its sp. action on the vegetative nervous system.

R. C. W.

The effects of certain drugs on the capillaries: atropine, eserine, sparteine, digitalis, caffeine and cucurbititrin. I. S. BARKSDALE. *Southern Med. and Surg.* 89, 27-32(1927).—Frogs were used as subjects, the capillaries of the tongue and in the web of the foot being examd. Atropine exerts a constricting effect on the capillaries. Eserine has the opposite effect, although its action is not so prolonged. Sparteine produces marked capillary constriction. Digitalis has more of a dilator than constrictor effect. Caffeine produces a marked, general capillary constriction. Cucurbititrin dilates the capillaries and lowers the intracapillary pressure.

R. C. WILLSON

The use of *o*-iodoxybenzoic acid in the treatment of chronic arthritis. A. G. YOUNG. *Wisconsin Med. J.* 26, 346-50(1927); cf. *C. A.* 20, 3043.—Favorable report passed on 43 cases.

R. C. WILLSON

Relationship between the structure and the biological action of the cardiac glucosides (JACOBS, HOFFMANN) 10.

I—ZOOLOGY

R. A. GORTNER

The electric charge and agglutination in the amebocytes of marine invertebrates. E. FAURÉ-FRÉMIET AND G. NICHATA. *Ann. physiol. physicochim. biol.* 3, 247-306(1927). **The effect of the concentration of hydrogen ions on the amebocytes of marine invertebrates.** *Ibid* 307-16.—The cell activity as judged by the absorption of O₂ in the amebocytes of the *Asterias rubens*, is only slightly lowered at p_H 4.0 from that at p_H 7.4. At lower values than 3.0 there is a rapid drop in O₂ absorption to the lower limit of 1.8, where absorption of O₂ may practically stop. The effect of p_H is independent of the cation, the same results being obtained with CaCl₂ as with NaCl solns. An irreversible and lethal effect on the physical state of the protoplasm is produced by a p_H of 2.2, which is called the point of denaturation. This point varies for different amebocytes. The cessation of absorption of O₂ at p_H 1.8 is probably caused by an irreversible change in state which the cytoplasm commences to undergo at p_H 2.2. Although this is irreversible and lethal, the amebocytes may absorb O₂ when placed in neutral saline soln. but at an abnormal rate. **The action of some cations on the amebocytes of marine invertebrates.** *Ibid* 317-32.—The normal content of H₂O in the amebocyte of the *Asterias rubens* suspended in lymph is 76.9%. It is increased somewhat in isotonic MgCl₂ solns. and more so in NaCl and CaCl₂ solns. while it is slightly decreased in LaCl₃ soln. at the same p_H . At a const. p_H the O₂ absorption is greater in normal or dild. lymph than in unbalanced salt solns. It is more greatly decreased by NaCl and MgCl₂ than by CaCl₂, while it remains at the normal value when LaCl₃ is added to NaCl. The differences in physical characteristics of the cytoplasm caused by the different cations are not attributed to the variations in H₂O content caused by these solns.

H. J. D., Jr.

Hydrogen cyanide as an effective vermin destroyer. M. KAISER. *Wiener Zehlin. Wochschr.* 40, 882-6(1927).—Directions and precautions are given in detail.

D. B. DILL

The distribution of nitrogen in the blood and urine of the turtle (*Chrysemys Pinta*). F. H. WILEY AND H. B. LEWIS. *Am. J. Physiol.* 81, 692-5(1927).—In 8 samples of blood urea N varied from 4.7 to 26.0 mg. per 100 cc., amino N from 11.1 to 15.9 mg.; uric acid N from 0.1 to 1.4 mg. and total non-protein N from 34.4 to 81.9 mg. In the urine, urea N constituted from 24.1 to 47.8% of the total; NH_4N from 0.8 to 21.7%; amino N from 3.8 to 8.2% and creatine N 5.5% (one detn.). The N metabolism of the turtle is intermediate between the reptiles of the arid regions and the mammals, since both urea and uric acid in considerable amts. are found in its urine.

J. F. LYMAN

The physiology of reproduction in birds. XXII. Blood fat, and phosphorus in the sexes and their variations in the reproductive cycle. O. RIDDLE AND FRANCES H. BURNS. *Am. J. Physiol.* 81, 711-24(1927); cf. *C. A.* 20, 2531.—During the ovulation cycle of female ring doves the alc.-ether sol. substances in the whole blood were increased to 35% above the normal or resting value. The P contained in the ext. was increased 59% above the normal value. Normal male ring doves had less blood fat (1.77 g. per 100 cc.) than normal females (2.02) in the resting stage.

J. F. LYMAN

The parathyroid hormone. F. T. JUNG. *Am. J. Physiol.* 82, 22-6(1927).—The slight but definite mitigation of symptoms in parathyroidectomized rats subsequent to the implantation of the parathyroid glands of cats and dogs indicates the existence of a parathyroid hormone which is not species-specific.

J. F. LYMAN

The rate of killing of cladocerans at higher temperatures. L. A. BROWN AND W. J. CROZIER. *J. Gen. Physiol.* 11, 25-36(1927).—The velocities of killing of *Daphnia pulex* and *Moina macrocopa* were studied in the temp. ranges, 32-37° and 40-47°, resp. The velocity of killing at these supranormal temps. adheres to the Arrhenius equation for relation to temp. Over certain ranges of temp. the relationship between log. velocity of killing and the reciprocal of the abs. temp. is linear. Thermal killing involves the coagulation of protein. Differences in the temp. characteristic for the thermal killing process in closely related forms may be suggestive in regard to the mechanism of heat denaturing of proteins. The temp. limits within which the relations are linear are also those in which critical temps. for protoplasmic organization occur.

C. H. R.

The nature of the equation for growth processes. L. A. BROWN. *J. Gen. Physiol.* 11, 37-42(1927).—"An analysis of the growth curves of a cladoceran (*Pseudosida bidentata*) for one adult instar at each of 2 temps. is made by comparing the apparent gains or losses in time when the animals are transferred from one of these temps. to the other during the course of the developmental period. Since the curves for the 2 temps. when brought together at their end point do not coincide, the equation used to describe growth must have at least 2 velocity consts. unequally affected by changes in temp."

C. H. R.

The influence of some physical and chemical conditions of water on mayfly larvæ (*Cloëon dipterum* L.). H. S. PRUTHI. *Bull. Entomol. Research* 17, 279-84(1927).—Although H-ion concn. is a factor of great importance in the life of *Cloëon*, the CO_2 pressure is of greater importance and probably will afford a reliable index of the suitability of H_2O as a habitat for aquatic insects. *Cloëon* larvæ, and presumably other true aquatic insects, can withstand concns. of O_2 as low as 1 cc. per l., but in nature the concn. seldom goes so low. The exptl. results are given in tables.

C. H. RICHARDSON

12—FOODS

F. C. BLANCK AND H. A. LEPPER

Heat penetration in relation to pasteurization. M. A. JOSLYN. *Fruit Products J. and Am. Vinegar Ind.* 7, No. 2, 9-11(1927).

J. A. KENNEDY

The trend of modern food inspection. ARTHUR RIGBY. *Public Health J.* 18, 75-85(1927).—A general discussion of food inspection and of food poisoning, bacteriol. and chem. A bibliography of 19 references is included.

R. E. THOMPSON

The application of ultra-violet radiation to the investigation of food products. W. EKHARD. *Z. Spiritusind.* 50, 4(1927).—The application of radiation in the detection of adulteration in meats, eggs, milk and milk products, fats, flour, sugars, fruit juices and gums is discussed.

C. N. FREY

Determination of water in foods. K. J. HOLTAPPEL. *Pharm. Tijds. Nederland. Indie* 3, 247-61; *Chem. Zentr.* 1926, II, 1212.—The detn. of water in maize gives in the tropics incorrect results by every method which involves drying in air, even at 120°.

Distn. with xylene is the best method, in which with suitable app. difficulties arising from turbidity of the distillate are avoided. With the app. of Aufhäuser (*C. A.* 17, 2066) the reading is inexact, but this condition may be corrected by the use of more substance and by placing a spherical extension under the scale. In the xylene distn., dehydration is still more profound than by drying *in vacuo* at 100° with P_2O_5 . A greater advantage of the direct detn. is that the decompn. of the sugars as a function of time can be followed.

C. C. DAVIS

Food changes in an ice refrigerator and an electrically controlled refrigerator. VICTORIA CARLSSON. *Teachers College Record* 28, No. 7(reprint).—Milk, soups and other foods were kept for varying periods of time on the shelves of an ice refrigerator and an electrically controlled refrigerator and tested daily for changes in H-ion concn., bacterial count, taste and absorption of odor. All tests indicate less bacterial increase and more efficient food preservation in the electrically controlled refrigerator, probably because of a lower temp. and lower humidity in the refrigerator.

N. M. NAYLOR

The presence of formaldehyde in wood smoke and in smoked foodstuffs. E. H. CALLOW. *Analyst* 52, 391-5(1927).—Schryver's test for HCHO is shown to be sp. and to be given by wood smoke although not usually present in wood distillates prepd. out of contact with the air. Hams and bacons that have been smoked usually contain a little HCHO as shown by Schryver's test.

W. T. H.

Artificial coloring of alimentary pastes. B. KAYSER. *Pharm. Zentralh.* 68, 499-500(1927).—A discussion.

W. O. F.

Report of the milk products sub-committee on uniformity of analytical methods. A. MORE, *et al.* *Analyst* 52, 402-8(1927).—Official methods of analysis are given for the detn. of total solids and fat in condensed milk. The results of different chemists using these methods are shown.

W. T. H.

Graphical standardization of condensed milk products. W. V. PRICE. *J. Dairy Sci.* 10, 377-83(1927).—A description in detail, and an illustration of a graph worked out by P., for a simplified and short method of calcul. for the standardization of condensed milk products, from a mixt. of known amts. of raw materials.

J. C. JURRJEWS

Milk composition and energy. O. R. OVERMAN AND F. P. SANMANN. *Illinois Sta. Rept.* 1926, 91-2.—The energy value in cal. per qt. of milk F may be detd. within ± 12.22 cal. in 97% of the samples by use of the formula $F = 52.78A + 16.41B + 37.78D + 46.91E - 2.75C - 57.70$, when $A = \% \text{ fat}$, $B = \% \text{ protein}$, $C = \% \text{ sugar}$, $D = \% \text{ total solids}$ and $E = \text{sp. gr.}$. If only the $\% \text{ fat}$ is known, $F = 113.7334(A + 2.4404)$ should be used. The metabolizable energy may be expected to lie within ± 31.90 cal per qt. of the value obtained by the formula $F_m = 105.287(A + 2.4185)$. The true heats of combustion per g. of butter fat, milk protein, and milk sugar probably lie between the values of Abderhalden and Hammarsten and those found by Anderson.

A. L. MEHRING

The coagulation of milk. HENRI DE WAELE. *Ann. physiol. physicochim. biol.* 3, 113-20(1927).—Isoelec. casein is insol. but its salts of the alk. metals are sol. Casein of milk is a complex of Ca-casein-phosphate, the compn. of which depends on the p_H . From p_H 7.8 to 6.5 it is sol. but from 6.5 to 4 the amt. of Ca and also the soly. diminish progressively. Fats and lipoids do not change the soly. Rennet hastens the rate of coagulation where it is not very acid but it does not widen appreciably the zone in which coagulation can take place.

H. J. DEUEL, JR.

The souring of milk in an electric field and during thunderstorms. G. H. LEOPOLD. *Chem. Weekblad* 24, 438-9(1927).—An influence of an elec. field on the souring of milk has been sought. The potentials chosen were the same as those likely to occur during thunderstorms; the influence of a strong alternating field has also been studied. Nothing noteworthy has appeared in any of the cases investigated. It has been shown that potential differences which arise during thunderstorms, or during weather in which thunder is to be expected, have no influence on the souring of milk. An elec. field does not appear to affect the spontaneous movements of 2 kinds of bacteria brought into it.

J. C. JURRJEWS

Determination of the freshness of milk. G. INICHOFF. *Z. Untersuch. Lebensm.* 53, 435-9(1927).—The method of Morres is unsuitable for the detn. of the freshness of milk because of the variable results it gives with fresh milk and because it is influenced by many factors, such as pasteurization, freezing, preservatives, etc.

WILLIAM J. HUSA

Is the fat-free dry substance of milk of decisive significance for detection of watered milk? A. GRONOVER AND F. TÜRK. *Z. Untersuch. Lebensm.* 53, 520-4(1927).—The detn. of f.-p. lowering is of primary importance for detection of added water in milk.

WILLIAM J. HUSA

Experiments on obtaining correct average samples of milk. K. WEBER. *Z. Untersuch. Lebensm.* 53, 449-54(1927).—The expts. show the importance of thorough stirring in sampling milk from cans. WILLIAM J. HUSA

Determination of chlorine in milk. F. MAH AND W. LEPPER. *Z. Untersuch. Lebensm.* 53, 454-8(1927).—Dil. 50 cc. of milk to 400 cc. and add 40 cc. of a reagent which consists of 50 g. of phosphotungstic acid and 500 cc. of HNO_3 (sp. gr. 1.4) in H_2O to make 1 l. Shake, filter and titrate 100 cc. of filtrate by Volhard's method with addn. of ether. WILLIAM J. HUSA

The determination of small quantities of benzoic acid in milk, butter, margarine, meat and egg yolk. J. GROSSFELD. *Z. Untersuch. Lebensm.* 53, 467-83(1927).—In order to ext. BzOH from aq. soln. with ether, C_6H_6 , etc., previous complete removal of colloidal proteins is necessary. The removal of colloids may be brought about by distn. with steam, salting out, or by a soln. of $\text{K}_4\text{Fe}(\text{CN})_6$ and ZnSO_4 . A suitable colorimetric method for the detn. of small quantities of BzOH is based on reduction of BzOH in ammoniacal soln. by HONH_2 to red compds. WILLIAM J. HUSA

The polarimetric determination of sucrose in sweetened condensed milk. H. D. RICHMOND. *Analyst* 52, 525-6(1927).—Honegger (*C. A.* 21, 967) attributed to Revis and Payne a method which is really that proposed by Harrison. In fact, Honegger has practically gone back to the original procedure of Harrison which was modified somewhat by R. and P. The following suggestions are made for carrying out the method. (1) When dilg. the condensed milk, allow the soln. to stand at 60° for at least 30 min. (2) Then cool to 10° , add the acid $\text{Hg}(\text{NO}_3)_2$, mix and carry out the polarization test at as low a temp. as possible. (3) Use Harrison's method and formula. (4) The milk sugar results will be low as the pptn. is incomplete by $\text{Hg}(\text{NO}_3)_2$. Always treat the final filtrate with phosphotungstic acid and use the difference between the readings before and after this treatment as a correction for the initial polarization. W. T. H.

The cream plug, its causes and prevention. H. H. SOMMER AND K. M. ROYER. *J. Dairy Sci.* 10, 416-30(1927).—The cream plugs contain a high % of fat, and microscopic examn. shows that the fat has coalesced into irregular masses. The fundamental cause is the presence in the cream of large fat globules which will rise rapidly into a dense layer and coalesce, being most rapid at higher storage temp., because the serum through which the globules must rise is less viscous. The milk and cream should be handled therefore in such a manner, that partial churning is avoided, or if this is impossible, reducing the size of the fat globules by either emulsifying or homogenizing at low pressures. J. C. JURRJENS

The fat content of the milk of Flemish cows in Flanders. MARCEL PAGET. *Ann. chim. anal. chim. appl.* 9, 265(1927).—About 3.7-4.0% g. of fat was obtained in the milk. In some cases as little as 2.7% was obtained in the normal product from individual cows. W. T. H.

Variations in the proportion of solids-not-fat in milk. J. F. TOCHER. *Scottish J. Agr.* 10, 201-10(1927); cf. *C. A.* 21, 462.—The solid-not-fat content of 676 samples of milk from as many individual cows averaged 8.80%. The av. for milk from Ayrshire and Friesian cows was 8.75 and 8.62%, resp., and for other breeds 8.86%. The min. % for all breeds was 7.5 and the max. 10.75. The non-fatty solids in daily composite samples of milk from a herd of 24 cows varied from a min. of 8.4 to a max. of 9.7% during 39 days and the daily percentages fluctuated greatly. The % of non-fatty solids tended to decrease with increase in yield of milk and also with increase in age of the cow. Non-fatty solids tended to decrease to a min. at about 20 weeks after calving and then gradually increased. K. D. JACOB

Miscellaneous studies in the dairy division of the Illinois Station. M. H. CAMPBELL, M. J. PRUCHA AND J. M. BRANNON. *Illinois Sta. Rept.* 1926, 93-6.—A method for detg. the size of fat globules is given. The size of the fat globules in Holstein milk is smaller than in Guernsey milk. The protein edestin prepd. from cotton seed failed to increase the rate of milk secretion when fed at the rate of 5 ozs. per 1000 lbs. of live wt. of cow, although it is being sold for that purpose. Na and Ca hypochlorites and chloramine-T proved to be the best chem. sterilizers of those tried for dairy utensils. A soln. contg. 150 p. p. m. Cl should be used. The prepn. of acidophilus milk requires very careful control. Skim milk is twice pasteurized for 30 min. at 175°F ., cooled to 100°F ., and inoculated with 3% of its vol. of vigorous acidophilus culture. When the acidity is 0.5-0.6% it is cooled to 60°F . and enough cream to make the fat content 1% is added. Then 5-10% lactic starter is added and the milk is passed through a homogenizer and over a cooler. A. L. MEHRING

The refraction and lactose content of milk of different herds. G. SCHULZE. *Z.*

Untersuch. Lebensm. 53, 509-20(1927).—The refraction and lactose content of milk undergo corresponding fluctuations. The refraction gives sufficient indication of the lactose content. The refraction of evening milk averages higher than for morning milk. When there are 3 milkings a day the refraction is about the same for the noon and evening milk.

Gentian violet lactose peptone bile for the detection of *Bacillus coli* in milk. **MILDRD ADAMS KESSLER AND JOS. C. SWENARTON.** *J. Bact.* 14, 47-53(1927).—Gas in this medium is a positive indication of *B. coli* and, for practical purposes, needs no confirmation.

WILLIAM J. HUSA

JOHN T. MYERS

Concerning the addition of calcium chloride to milk for cheese making. **W. V. PRICE.** *J. Dairy Sci.* 10, 373-6(1927).—Expts. were conducted under carefully controlled conditions, which approx. com. methods of manuf. accompanied by careful and exact observations and measurements. The CaCl_2 stimulated the action of rennet to such an extent, that it was necessary to reduce the amt. of rennet added to the milk in the test vat to $\frac{1}{2}$ the amt. used in the check vat, while the coagulation was also more rapid in the former. The direct result of the influence of CaCl_2 on the rennet action was a faster and firmer coagulation and a more rapid loss of moisture after cutting. At the time of pressing, however, the moisture contents of the 2 lots were practically identical. The results of the scoring of the cheese do not prove definitely that the CaCl_2 has a harmful effect upon the quality of the cheese.

J. C. JURRIJENS

Increasing the yield of cheese by the addition of calcium chloride to milk. **GEORGES KNAYSI AND J. D. NELSON.** *J. Dairy Sci.* 10, 396-9(1927).—A certain increase in cheese was always secured when CaCl_2 was added to the milk previous to the addn. of rennet ext., the increase probably varying with the compn. of the milk, as well as with the amt. of CaCl_2 added. Anhyd. CaCl_2 should be used. There was not only an increase of 5% in cheese, but there is a saving of rennet ext., and there are possibilities of reducing the amt. of starter. The curd is more easy to handle and the cheese has probably a superior nutritive value due to a more complete pptn. of the P_2O_5 and the Ca, while there are yet no indications of an impairment of flavor or ripening qualities of the cheese. The authors feel justified in advocating a thorough trial of the use of CaCl_2 in cheese making.

J. C. JURRIJENS

Black spot in cheese. **R. H. LEITCH.** *Scottish J. Agr.* 10, 165-71(1927).—Black spot in com. cheese could not be traced to bacterial or enzymic origin nor to the presence of salts of Zn, Cu or Fe, but appeared to be due entirely to minute traces of Pb, 1-2 p. p. m. Com. and c. p. red lead, white lead, Pb paints, Pb acetate, Pb solder and incrustations on the interior of Pb water pipes, all produced black spot when added to cheese in minute traces. The principal source of Pb contamination in cheese making is probably the cheese vat itself, the Pb being derived from Pb paint used on the walls of the steam jacket and from solder used in joining the seams of the vat. Introduction of elemental S into the raw curd during the process of manuf. did not induce black spot but imparted a very undesirable odor and taste to the ripe cheese.

K. D. JACOB

Vacuum method extends cheese life. **J. M. SHERMAN.** *Glass Container* 6, No. 5, 18(1927).—Both cream cheese and cottage cheese when packed under high vacuum in glass jars retained their flavor, consistency and palatability after storage for a year below 50°F.

CARL R. FELLERS

The relation of the Manley and Reichert figures for butter analysis. **H. S. SHREWSBURY.** *Analyst* 52, 388-90(1927).—The Manley figure gives an approximation to the Reichert-Meißl value if the equation $R = 100M/84.16$ is used, in which R designates the Reichert-Meißl value and M the Manley figure. The explanation of the discrepancy does not appear to be that given by Manley (*C. A.* 21, 1853).

W. T. H.

Great industrial chemical plants. A visit to the van den Bergh plant at Villastellone. **A. CHIAROTTINO.** *Notiz. chim.-ind.* 2, 427-8(1927).—An illustrated description of the manuf. of artificial butter.

C. C. DAVIS

Butter composition control. **W. F. JONES.** *World's Butter Rev.* 1, No. 1, 17-9(1927).—A description in detail of a method of mfg. butter that permits of controlling the compn., without injuring the workmanship of the butter.

J. C. JURRIJENS

The hydrogen-ion concentration of cold-storage butter. **E. H. PARFITT.** *World's Butter Rev.* 1, No. 3, 11-5(1927).—The av. H-ion concn. of butter increased during storage from p_H 6.13 to 6.43. As the score decreased, excepting scores over 94 and under 89, the p_H decreased. Butters showing a high no. of proteolytic type organisms showed greater increase in p_H during storage than those with a low no. The p_H of butters criticized for alk. flavor was on the acid side, but the increase in p_H during storage was 1.03. Butters in which starters were used showed the least variation in p_H during storage.

J. C. JURRIJENS

Mold and yeast counts and their relation to the composition of butter. H. MACY. *J. Dairy Sci.* 10, 384-95(1927).—Mold and yeast counts of 2700 samples of butter are given as well as the compn. Apparently the moisture content of the butter had no particular relationship to the counts. The mold and yeast counts are compared with the concn. of moisture, salt and "salt in brine." The salt content of the butter had a marked effect on both counts. The % of "salt in brine" seemed to show an effect upon the mold and yeast counts. The influence of higher concns. of salt and "salt in brine" appeared more marked for mold than for yeast counts. J. C. J.

The neutralization of cream for buttermaking. H. A. BENDIXEN. *World's Butter Rev.* 1, No. 3, 5-9(1927).—A discussion in detail of the use of different kinds of neutralizers as used in the creamery, and how to use them. J. C. JURJENS

The composition of bran and pollard: means for distinguishing quality. L. D. FOSTER. *New Zealand J. Agr.* 35, 19-22(1927).—Twelve samples each of bran and pollard, sepd. from pure local varieties of wheat in an exptl. mill, were analyzed. The av. results were H₂O 12.11 and 12.16, protein 13.55 and 15.21, fiber 10.68 and 4.65, ash 5.00 and 3.29, oil 3.70 and 4.23, carbohydrates 58.31 and 60.78% for bran and pollard, resp. The results agreed closely with those obtained by Wood and Adie (C. A. 11, 2834) on samples of com. English brans and pollards. The pollards also resembled closely in compn. a series of good av. quality, com. pollards milled locally. The av. results showed a distinct difference between bran and pollards in protein, fiber, ash and carbohydrates. F. considers the differences to be significant enough to afford a means of distinguishing between fair av. quality and adulterated pollards. K. D. J.

Some observations on the washing of gluten from flour. D. W. KENT-JONES. *Analyst* 52, 439-43(1927).—The use of a special soln., such as that suggested by Dill and Alsberg, does not eliminate the errors inherent in the gluten detn. Personal differences in the manipulation of gluten and dough cause variations in results even when different operators are using the same method. Each individual, however, ought to be able to get consistent results so that the ratio between the N content of the flour and the dried gluten should be approx. const. W. T. H.

A numerical expression for the color of flour. D. W. KENT-JONES. *Analyst* 52, 443-52(1927).—The color of flour can be expressed by the tints given to 2 different solvents. The yellow color can be extd. by gasoline and detd. in a special form of colorimeter which is shown. This value gives what may be called the natural whiteness or the artificial bleach of the flour. The grade of the flour can be judged by the amt. of reddish brown pigment present, which presumably comes from oil and can be detd. in the same colorimeter after extn. with alk. methanol. W. T. H.

Estimation of fat content of flour and milling stocks. C. W. HERD. *Cereal Chemistry* 4, 370-6(1927).—Less fat is extd. by ether from completely dried flour and stocks than from moist or partly dried stocks. The lower fat content found in flour after drying is not due to loss in "steam distillation" as suggested. The discoloration of flour on drying is probably due to a change in the fat or assocd. material, but this change does not account for any gain in weight. Values for the refractive index of wheat oil are given. The change in the fat is probably not an oxidation, but possibly an internal alteration, the nature of which was not detd. L. H. BAILEY

Observations on the estimation of the neutralizing value of acid calcium phosphate. C. W. HERD. *Cereal Chemistry* 4, 347-69(1927).—A comparison is made between the electrometric and colorimetric titrations of 2 acid phosphate powders. It is shown that the normal cold titration is dependent upon the rate of addn. of the alkali and consequently is not satisfactory. The hot direct method suffers from the same disadvantage. In the hot inverse method, the colorimetric end point agrees with the electrometric inflection, if the following conditions are observed: thymol blue used as indicator, or a small quantity of phenolphthalein; the mixture is heated until equil. is reached. The result of this method gives a figure which is too high for com. practice, but is characteristic of that particular phosphate powder. Bailey's p_H method is useful for checking the correct mixt. of a raising powder and can, with advantage, be used to correlate the above titration figure with the most satisfactory acid phosphate: NaHCO₃ ratio for baking practice. The p_H of satisfactory baked scones is 6.55 to 6.85. L. H. BAILEY

Interpretation of baking tests. L. W. HAAS. *Cereal Chemistry* 4, 389-94(1927).—The important points to consider in judging a test loaf are: measured loaf vol., oven spring, shape, bloom, grain, texture, color of crumb, flavor and odor. A voluminous test loaf indicates a strong flour, providing that the oven spring, grain and texture are good. The oven spring or break is also a valuable indication of the strength of a flour. The break should be bold and shreddy and show no signs of shortness, tearing or splitting.

Lack of oven spring or a ragged break indicates a weak or possibly a green or freshly ground flour. A flour which produces bold, voluminous test loaves on both a long and a short fermentation indicates strength and good stability. When a short fermentation loaf appears to be gluten bound and a very long fermentation loaf shows good quality, unusual strength is indicated. Flours of this type are best used as sponge flours, or in hearth bread or in a blend with flours of lower strength. A pale sickly bloom indicates an over-bleached or otherwise damaged or defective flour. The grain should be close and uniform with thin-walled slightly elongated cells. An open grain may indicate a damaged flour, or it may show improper fermentation. The texture of the loaves should be smooth and silky. A clear, bright, creamy white color is by far the most desirable; dull gray is objectionable. Test loaves should be examd. for flavor and odor, any indications of mustiness or other foreign odors being noted. Unsound damaged or over-bleached flours usually have a characteristic "off" flavor and odor. Certain chem. data are of value in properly interpreting or checking the baking test. Among these are moisture, ash, protein and acidity, but the most important test is the baking test.

L. H. BAILEY

The role of phosphates in bread making. R. A. BARACKMAN AND C. H. BAILEY. *Cereal Chemistry* 4, 400-10(1927).—The authors' studies indicated that 0.2% and 0.4% of Ca acid phosphate increased the rate of CO₂ production. It has previously been indicated that such dosages of acid phosphate did not appreciably affect the rate of loss of gas from the dough. It accordingly followed that toward the close of the fermentation period the doughs contg. phosphate were larger in vol. than the non-phosphated doughs. Larger dosages of acid phosphate apparently tended to impair the gas-retaining capacity of the dough and thus to counteract the tendency toward a greater increase in expansion or vol. of the dough. Expts. were made which showed that there was no appreciable increase in the no. of yeast cells in the phosphated doughs over the non-phosphated ones but that there was greater activity of the cells in the production of alc. and gas.

L. H. BAILEY

Pre-harvest factors which affect wheat quality. C. F. MANGELS. *Cereal Chemistry* 4, 376-88(1927).—An attempt has been made to summarize the effect of the more important pre-harvest factors which affect the quality of wheat. These have been discussed in terms of test weight and protein content. For the sake of brevity no discussion of the effect of climatic and other factors on diastatic activity has been included, but data collected on North Dakota wheat indicate (Mangels 1926) that the diastatic activity of spring wheat tends to vary inversely as the protein content. The variation in diastatic activity may account for the relatively low baking strength of some lots of very high protein wheat. Pre-harvest factors affecting wheat quality invite further study. Certain factors are at least partially under the control of the grower, and further study of such factors should give the wheat producer a larger measure of control over the quality of the wheat produced.

L. H. BAILEY

Surveying the new wheat crop. R. C. SHERWOOD. *Cereal Chemistry* 4, 395-400 (1927).—Survey of the wheat crop immediately following harvest will provide valuable information concerning the character of the wheat prior to the movement to market in large quantities. Protein content, weight per measured bushel, and ash content are detns. which can be most readily utilized in a survey organized to obtain data concerning wheat quality. Lab. milling and baking tests of composite wheat samples are very useful when it is feasible to include them. Comparisons of protein content of Minnesota wheat as surveyed at harvest time and as marketed during the months following have shown close agreement for the crop years 1924, 1925 and 1926.

L. H. B.

The digestibility of wheat by-products. HARRY SNYDER. *The Northwestern Miller* 151, 923(1927).

L. H. BAILEY

Fruit jellies. V. The role of pectin. 1. The viscosity and jellying properties of pectin solutions. P. B. MYERS AND G. L. BAKER. *Univ. of Del. Agr. Expt. Sta. Bull.* 149 (1927); cf. C. A. 21, 3688.—The addn. of an acid or alkali to a pectin soln. at room temp. causes a drop in the viscosity of the soln. The decrease in viscosity with increase in acidity or p_H is negligible in comparison to the decrease in viscosity caused by the addn. of an alkali to the soln. or a decrease in its p_H . The max. viscosity of a pectin soln. occurs at the initial p_H of the soln. No indication of the isoelec. point of pectin is obtained through its viscosity measurements as Loeb has shown to be the case with proteins. Jelly strength is a function of the viscosity of the pectin soln. from which the jelly is made. This relationship is independent of the concn. of pectin. The sugar necessary to add to a pectin soln. to produce a jelly of given strength is dependent upon the viscosity of the pectin soln. Since the yield of jelly is dependent upon the amt. of sugar added and since the amt. of added sugar is dependent upon the

viscosity of the pectin soln., the viscosity of the soln. dets. the yield of jelly. The p_H at the optimum point of jelly formation varies with the concn. of pectin. The viscosity of a pectin soln. decreases rapidly as the time of boiling the soln. with acid is increased, the p_H and other factors remaining const. The % of pectic acid, detd. by the Wichmann method, is not an indication of the jellying power of the pectin. Reasons are given for doubting the accuracy of the modified Ca pectate method as a means of detg. the jellying power of a pectin. The method used for the pptn. of pectin with EtOH has an appreciable effect on the quality of the resulting pectin. Of the methods tried, running the EtOH into the pectin soln. dropwise, with const. stirring, produced the better quality pectin. Prolonged heating of a pectin soln. has a deleterious effect on the jellying power of the soln. The higher the temp. the greater the decrease in jellying power of the pectin. Boiling pectic substances with EtOH increases the % of H₂O-sol. pectin in the material. Boiling pectic substances or free pectin in EtOH decreases the jellying properties of the resulting pectin. A method is described for the prepn. of a high quality pectin. Contrary to the general belief, pectins obtained from pectic substances by extn. with distd. H₂O are not necessarily of a higher quality than those extd. by means of an acid soln. It is contended that pectins should be bought and sold on a basis of their jellying power.

CARL R. FELLERS

Jellies and jams made with and without an extracted pectin. VICTORIA CARLSSON. *Teachers College Record* 28, No. 8, (reprint) 11 pp.—The advantages of the use of an extd. pectin in the prepn. of jelly and jam are: jelly can be made with any available fruits, fully ripe or less mature, some of which naturally are deficient in jelly-making constituents; the time of cooking jelly or jam is shortened; the yield of jelly is increased and the cost per glass is reduced. The disadvantages of the use of an extd. pectin in prepn. of jelly and jam are: jellies tend to liquefy on standing; paraffin loosens from the edges of the glass; the jams are too firm and the pectin may impair natural fruit flavor; the jams cost more per glass.

N. M. NAYLOR

Sulfuring dried fruit. I. Apricots. W. R. JEWELL. *J. Dept. Agr. Victoria* 25, 457-62(1927).—The factors affecting the SO₂ content of dried apricots were studied in expts. carried out in com. sulfuring houses with full charges of fruit. Samples of the dried fruit were analyzed for SO₂ 5-6 weeks after sulfuring. Under accurately controlled conditions apricots could be more economically sulfured in air-tight houses than in loosely closed ones but in the latter a wider variation in the conditions of treatment was possible without leaving an excess of SO₂ in the fruit. The SO₂ content varied from 11.9 to 22.5 grains per lb. in fruit exposed for 4 to 15 hrs., resp., when S was burned at the rate of 8 lb. per ton of fruit in an air-tight house, and the SO₂ content varied with the amt. of S burned when the period of exposure was const. The SO₂ content of the dried fruit also varied directly as the H₂O content of the fresh fruit. The results of the expts. indicated that in order not to exceed a max. SO₂ content of 14 grains per lb. of finished product the amt. of S burned should be limited to 8 lb. per ton and the time of exposure should not exceed 4 to 5 hrs. during the day or 12 to 14 hrs., at night when the sulfuring is done in a loosely closed house. In tightly closed houses for day sulfuring 7 lb. of S per ton of fruit with 5 hrs.' exposure is recommended and for night sulfuring 5 lb. per ton with 12 hrs.' exposure.

K. D. JACOB

"Mikrobin" (sodium *p*-chlorobenzoate). C. VON DER HEIDE AND R. FÖLLEN. *Z. Untersuch. Lebensm.* 53, 487-509(1927); cf. *C. A.* 20, 2884.—*p*-Chlorobenzoic acid (I) is detected by a modification of Mohler's method for the detection of BzOH; the acids are differentiated by the behavior of their nitro derivs. with HONH₂. I is detd. as AgCl. Extensive data are given on the soly. of I and its Na salt in H₂O, alc., fruit juices and wines. I checks the growth of yeasts better than BzOH or salicylic acid but is inferior to BzOH against molds.

WILLIAM J. HUSA

The determination of sulfur dioxide in dried fruit. PERCY MAY. *Analyst* 52, 526(1927).—Miller's method (*C. A.* 21, 2743) should be of value as a quick sorting process but if the amt. is near the prescribed limit, the detn. should be repeated, using considerable acid with a reflux condenser or using a gravimetric method as previously recommended by Monier-Williams (*C. A.* 21, 2510). Cf. *C. A.* 21, 2742. W. T. H.

The utilization of the excess potato crop in America. K. BIERLING. *Z. Spiritusind.* 50, 211(1927).—Addn. of potato flour to wheat flour has been recommended. McCollum has shown that cereal proteins are improved by the addn. of potato protein. Hind-hede found potato protein a valuable food. The industrial utilization of potatoes is very little developed. Germany might utilize more potatoes for food and refrain from importing wheat.

C. N. FREY

The determination of the starch content of potatoes. W. EKHARD. *Z. Spiritusind.* 50, 271(1927).—The methods of Reimann and of Parow were compared and found to

check very well for sound potatoes, but with wet, decayed potatoes the Parow method gave results somewhat too high. C. N. FREY

Determination of sugar in chocolate. WILHELM MÜLLER. *Mitt. Lebensm. Hyg.* 18, 296-9(1927).—A comparison of the methods for sugar as given in Schweiz, Lebensmittelbuch 3, (1917) indicates that of these, the most reliable and const. results are obtained with the *sugar method of von Fellenberg*. RUSSELL C. ERB

The natural occurrence of boron compounds in cacao and cacao products. A. S. DODD. *Analyst* 52, 459-66(1927).—In ordinary chocolate there is a normal content of B equiv. to 0.01% of H_3BO_3 . Cacao beans and cocoa contain 0.02-0.08% H_3BO_3 . Similarly, coffee beans contain about 0.01% of H_3BO_3 . In Thomson's method for detg. boric acid, the use of *Sofnol Indicator* No. 1 is advised in place of methyl orange. W. T. H.

The microscopic determination of shell content of cacao powders. RICHARD TURNAU. *Z. Untersuch. Lebensm.* 53, 483 6(1927).—Expts. on the detection of shells in cacao products by counting the stone cells are described. WILLIAM J. HUSA

Fermentation and the preparation of cocoa. M. PORTERES. *Rev. botan. appl. agr. colon.* 7, 36-47(1927).—Results are given of expts. in the technic of cocoa prepn. M. S. ANDERSON

The "Indian tea fungus." F. DINSLAGE AND W. LUDORFF. *Z. Untersuch. Lebensm.* 53, 458-67(1927).—The "Indian tea fungus" causes fermentation in a tea infusion sweetened with sucrose, yielding a beverage contg. alc., HOAc and lactic acid in addn. to compds. which give an aroma. The supposed medicinal value of this beverage may be attributed to its laxative action. WILLIAM J. HUSA

Boric acid in coffee. WM. PARTRIDGE. *Analyst* 52, 401(1927).—In all of 31 samples of coffee examd. during the last 2 years from 6 different countries, the turmeric test for H_3BO_3 was obtained although there is no mention of this acid being used in coffee culture either in English or French literature. W. T. H.

Siena coffee. Results of chemical analyses. (MISS) ERSILIA CARLI. *Notiz. chim.-ind.* 2, 507-8(1927).—Beans from plants of the *Coffea arabica* which had been cultivated in Siena and had flourished extremely well were analyzed in comparison with colonial coffee. The data give the % compn. of the Siena and the colonial coffee, resp.: water, 10.34, 10.2-10.7; caffeine, 0.81, 0.9 1.1; fats, 11.36, 11.8 12.2; ash, 3.9, 3.1-5.3; aq. ext., 24.2, 28.31; reducing sugars, 6.3, 7.6 11.8. The analyses show that coffee may be cultivated away from the tropics and still form caffeine in almost normal quantity. C. C. DAVIS

Grading of carbonated beverages. J. H. BUCHANAN, E. E. PETERSON, J. H. TOULOUSE AND MAX LEVINE. *Glass Container* 6, No. 10, 13 36(1927).—A detailed discussion of scoring carbonated beverages is given. The following grading system is suggested: appearance, 25 points; taste, 25; food value, 25; absence of organisms, 8; gas vol., 7; acidity, 5; freedom from preservatives, 5. The 25 points allotted for "appearance" are made up as follows: fill, 1; color, 7; freedom from sediment and turbidities, 15; and freedom from emulsion break, 2. CARL R. FELLERS

The value of lactic acid in the preservation of mayonnaise dressing and other products. MIRIAM S. ISZARD. *Glass Container* 6, No. 4, 16 (1927).—Lactic acid treatment of mayonnaise and salad dressings seems to be a feasible method of arresting bacterial spoilage; first, because this acid is not harmful from a health point of view, and secondly, because the amt. necessary to use does not alter the taste as would vinegar were it employed in sufficient amts. to arrest bacterial development. Acidity of 1.75% lactic acid was the least amt. necessary to prevent deterioration of the product over a period of 5 months. CARL R. FELLERS

Some effects of freezing on onions. R. C. WRIGHT. *U. S. Dept. Agr. Dept. Circ.* 415, 1-8(1927).—The av. f. p. of onions of the globe type is 30°F. though the f. p. varies with the temp. at which they are held in storage. Onions may undercool below their f. p. without freezing; thus freezing does not always follow exposure to low temps. They should not be moved or handled roughly when cooled to temps. below their f. p. for if undercooled and so handled they are likely to freeze immediately. Freezing injury is easily confused with the results of physiol. breakdown. Onions with only the outermost scales injured by freezing may, as a rule, be salvaged if allowed to dry out. CARL R. FELLERS

The effect of common salt on lime water used for egg preserving. JAMES MILLER. *Analyst* 52, 457-8(1927).—Often NaCl is added to lime water used for preserving eggs but expts. show that whereas the addn. of a little NaCl does no harm, this is not the case when considerable NaCl is used. W. T. H.

Food values of New Zealand fish. VIII. Stewart Island oysters. JOHN MAL-

COLM. *Trans. Proc. New Zealand Inst.* 58, 167-73 (1927); cf. C. A. 20, 3754.—The oysters examd. all showed the presence of vitamin A when tested on rats that were supplied with the antirachitic factor. Dried oysters contained vitamin A in smaller equiv. quantities than fresh oysters. Dehydration of the food material by plaster of Paris followed by ether percolation gave much better results than ordinary drying of the material followed by Soxhlet extn. with ether. There is a loss of food value of the oyster in the process of spawning. The proportion of total N that exists in the non-protein form in the oyster is relatively large.

I. W. RIGGS

Annual report of 1924 of the experimental station for the canning industry. H. SERGER AND H. KIRCHHOF. *Konserven-Ind.* 13, 332-3, 351-5, 363-4, 374-6; *Chem. Zentr.* 1926, II, 2125.—White points in the jelly of some samples of "herrings in jelly" were identified as colonies of bacteria. *Sea salmon* of an abnormally intense red color became normally red when treated with EtOH or with 3% aq. NaCl. *Canned crabs* contained 0.21-0.44% H_3BO_3 . *Pickles* contained at the most 2.5% acid, and were preserved with H_2O_2 . *Segeberger salt* was only NaCl. The removal of difficultly sol. glycerides by cold crystn. from a sample of *nutrient beef fat* rendered it unattractive in appearance. "Dioxon" (H_2O_2) had a distinct preservative effect on sour pickled vegetables, but bleaches them and alters their flavor. "Microbin" and "Servin" can always be detected in small quantities. *Servin*, which contains 5.9% acids as AcOH and 0.7% HCO_2H , permits shorter heating in the canning of fruits and vegetables. The process by which EtOH is burned on the surface of the material to be preserved to sterilize the surface of the latter and at the same time to seal automatically the glass container is not so reliable as the ordinary boiling process. Six samples of *benzoate* contained 33.02-81.50% BzOH.

C. C. DAVIS

The behavior of the anthocyan pigments in canning. C. W. CULPEPPER AND J. S. CALDWELL. *J. Agr. Research* 35, 107-32 (1927).—The discoloration of fruits and vegetables canned in Sn is due to the reaction of the anthocyan pigments present with Sn dissolved from the container and results in the formation of complex metallic compds. of anthocyan which are violet in color. The quantity of violet compd. formed is detd. by the amt. of pigment present and by the degree of acidity in the medium, low acidity favoring its formation and high acidity depressing it. The anthocyan of the peach has been isolated and partially purified. Its behavior toward metals is similar to that of other anthocyan pigments. Anthocyan plays an important role in causation of corrosion and perforation wherever it is present. This occurs for the reason that the metal salts formed by combination of the acids of the fruit with the can metal are broken up by transfer of the metal into combination with the pigment releasing the acid to continue attack upon the can. An enameled can preserves the original color of red fruits and reduces discoloration by decreasing the contact between pigment and metal, but it increases the rapidity with which perforations of the metal occur by limiting the area from which metal can be removed.

W. H. ROSS

Temperature in bottles after filling with hot catsup. S. H. AYERS AND A. G. OSBORNE. *Glass Container* 6, No. 3, 5-10; No. 4, 5-42 (1927).—Fermentation and spoilage troubles in bottled catsup prompted this investigation. Thermocouples were used to measure temps. within the bottle. Wide variations in temp. exist at different points within the container. The temp. in the center of the catsup was nearest the filling temp.; at other points it fell below the filling temp. The differences in temp. in a given container vary with the temp. of the container when it is filled with hot catsup. In commercially filled catsup bottles the temp. on the inner surface of the cap never reaches a point high enough to have pasteurizing value. This is true regardless of whether the container is upright or on its side. A short heat treatment for hot-filled bottled catsup after capping is effective in raising the temp. sufficiently to prevent spoilage. Catsup should be filled at temps. above $170^{\circ}F$. capped and processed for at least 5 min. at $190^{\circ}F$.

CARL R. FELLERS

An automatic caustic testing apparatus for control of detergent solutions in bottle washing. M. E. PARKER. *Glass Container* 6, No. 3, 20-46 (1927).—The active germicidal and cleansing properties of detergent solns. are detd. to a considerable degree by their caustic concns. (NaOH). The use of hydrometers or titration with phenolphthalein alone was found unreliable. The Warder method (cf. Treadwell-Hall, *Analytical Chemistry—Quantitative*, Vol. 2, 564 (1916)) was found best for the detn. of alkali carbonate and hydroxide in the presence of each other. The special feature of the *automatic caustic testing app.* designed to use the Warder method is a double-scale buret calibrated to give directly the % of the 2 alkalies in detergent solns. Inexperienced persons are able to operate the app. with accuracy.

CARL R. FELLERS

Feeds for dairy cattle. W. B. NEVENS. *Illinois Sta. Rept.* 1926, 90-1.—Dairy

cows eating a liberal amt. of legume hay showed no desire for CaO in the form of finely ground limestone to which they had free access. Corn contg. 25-35% dry matter at the time of harvest made silage with better keeping qualities and higher feeding values than varieties not coming within these limits. The digestion coeffs. of silage made from 3 varieties of corn are given in tabular form. Cows on high-protein rations give less milk.

A. L. MEHRING

Specific and poisonous properties of feeding stuffs. J. ALAN MURRAY. *Fertiliser, Feeding-Stuffs and Farm Supplies J.* 12, 645-7(1927).—The specific and poisonous properties of plants and feeding stuffs are discussed with reference to their effect on animals.

K. D. JACOB

A technical study of the digestibility of corn-stover silage for beef cows. T. S. HAMILTON AND H. P. RUSK. Univ. Illinois, *Bull.* No. 291, 467-84(1927).—Digestion expts. with 8 beef-type cows showed the av. coeffs. of digestibility of corn-stover silage to be as follows: dry protein, 38%; N-free ext., 56%; crude fiber, 67%; ether ext., 59%. There are about 85% as much total digestible nutrients in stover silage as in the same wt. of whole-corn silage. However, exptl. feeding trials indicate that in practical feeding, stover silage is only about $\frac{2}{3}$ as valuable as normal silage. No considerable change in chem. compn. is brought about by ensiling corn stover, and there is little change in availability in the ruminants. The value of ensiling stover lies chiefly in its increased palatability and in smaller waste in feeding. The metabolizable energy of corn-stover silage varied from 1.35 to 1.71 therms per lb. with an av. of 1.57 for the 8 cows.

M. S. ANDERSON

A comparative investigation of the acid content of ensilage by Wiegner's method and the determination of the hydrogen-ion concentration. K. NEHRING. *Z. angew. Chem.* 40, 1058-60(1927).—In Wiegner's method for examg. ensilage, free and combined volatile fatty acids are detd. by distg. with steam, and lactic acid is detd. by direct titration of the aq. ext. N. substitutes detn. of the p_H value, and confirms Behren's results (*C. A.* 21, 1318). In making ensilage the fermentation is conducted so as to make lactic acid and not acetic and butyric acids. With a p_H of 4.25 or lower ensilage is free from butyric acid. With p_H to 4.75 only small quantities of butyric acid are present, but acetic acid has made its appearance. If p_H is above 4.80 butyric acid is always present, indicating poor ensilage. The detn. of p_H , therefore, gives a rapid and accurate method for detg. the value of ensilage, that with a value below 4.5 being considered good, that from 4.5 to 4.7 as fair to good, and that over 4.8 as bad.

W. C. EBAUGH

The purification of corn-starch sirup by means of Norit (BARTLING) 28. The determination of moisture by the volatile solvent method (JONES, McLACHLAN) 7. The relation of maturity of California plums to shipping and dessert quality (ALEN, *et al.*) 11D. The non-protein N in certain dairy rations and the partition of N in the urine produced thereon (KRAUSS) 11E. The tannin cells in the fruit pulp of different varieties of *Diospyros* (GRIEBEL) 11D. Examination of halophilic microorganisms (CLAYTON, GIBBS) 11C. Seasonal variations in the carbohydrate content of swedes (CALDWELL) 11D. Co(SCN)₂, as a microchemical reagent [in the examination of flours and foodstuffs] (GREGER) 7. The use of hypochlorites as a sterilizing agent for dairy utensils (HOY RENNIE) 11C.

Food mixtures. A. LEO. U. S. 1,643,950, Oct. 4. A compn. for use in making meringues, marshmallows, etc., is formed with albumin and pectin. U. S. 1,643,951 specifies the use together of albumin, pectin, NaHCO₃ and citric acid.

Treating flour, etc. E. STAUDT. Can. 274,290, Sept. 27, 1927. Ground products, such as flours, are treated, to shorten the maturing process and improve their baking qualities, with a mixt. of gaseous ClO₂ and an inactive gas to obtain the necessary low concn.

Cereal food product (bread). F. MATZELLE. U. S. 1,643,507, Sept. 27. Bread of texture similar to that of ordinary white bread is prepd. by a specified formula, in which gluten flour and buckwheat flour are used together with other ingredients such as those usually employed for making white wheat bread.

Vitamins. A. W. OWE. Can. 273,982, Sept. 20, 1927. Fats contg. fat-sol. vitamins are sapond. and an edible fat is added to the sapon. product so as to dissolve the fat-sol. vitamin. The resulting vitaminized fat is sepd. from undissolved matter.

Conditioning dried fruit. SUN-MAID RAISIN GROWERS OF CALIFORNIA. Brit. 262,983, Feb. 16, 1926. Raisins, currants, figs, prunes or other dried fruits are treated by passage, with agitation, through a zone of intense heat at such a speed that the

duration of the treatment is so short that injurious scorching of the fruit is avoided. Oil extd. from raisin seeds or other oil may be atomized and sprayed on raisins in a cooling device. Brit. 262,989–90 specify app. for carrying out this or similar processes.

Preserving egg contents. H. F. ZOLLER. U. S. 1,643,913, Sept. 27. Raw egg material is mixed with $1\frac{1}{2}$ –2% of ethylene glycol and the mixt. is frozen.

Butter. S. KARPINSKY and J. S. ANDERSON. U. S. 1,644,254, Oct. 4. Cream previously charged with air is passed through a series of fine interstices in close succession and in an extremely sinuous path. An app. is described. Cf. C. A. 20, 1476.

Butter. G. A. GRAY and M. B. NEWBURGER. U. S. 1,643,301, Sept. 27. SO_2 is added to cream prior to shipment, the SO_2 is oxidized by the use of H_2O_2 after shipment, and the cream is then fermented and churned into butter.

Purifying milk and milk products. MARGARET B. MACDONALD. U. S. 1,644,842, Oct. 11. Foreign odors and flavors are removed by mixing with a mineral oil, e. g., a refined paraffin oil, and then sepgg. the oil.

Pasteurizing apparatus with cooler and separator. AKTIEBOLAGET SEPARATOR. Swed. 63,240, June 28, 1927.

Apparatus for producing smoke for curing meats, etc. H. M. ROBERTSON. U. S. 1,644,693, Oct. 11.

Food for animals. S. M. CORBETT. Brit. 263,047, June 29, 1926. After pressing out the juice from pineapple "shells," cores, trimmings and ends, the residue is thoroughly dried at a temp. above the b. p. and may be pulverized and used alone as a food or mixed with other ingredients such as wheat middlings, coconut or cottonseed meal or tannage.

Cattle food. A. BU. Brit. 263,014, April 26, 1926. Molasses or treacle is mixed with herring or other fish, seal or whale meat or with their waste products. H_2O may first be pressed out of the raw material after finely dividing it.

Treating molasses for use in stock foods. J. H. LEFTWICH. U. S. 1,643,666, Sept. 27. Low grade or final by-product molasses is mixed with decolorizing C which is allowed to remain with the molasses to prevent undesirable discoloration of composite stock foods in which the molasses is associated with other ingredients.

13—GENERAL INDUSTRIAL CHEMISTRY

HARLAN S. MINER

Japan as a market for chemicals. WALTER BUCHLER. *Ind. Chemist* 3, 383–4 (1927). E. J. C.

New syntheses in the solvent industry. VOSS. *Kunststoffe* 17, 79–80, 132–4, 205–7 (1927).—Recent patents are reviewed on processes dealing with the generation of MeOH from water gas, direct oxidation of CH_4 to MeOH, manuf. of MeCl and MeBr from CH_4 and the oxidation of these to MeOH and the manuf. of MeOH from CO. D. THURSEN

The recovery of volatile solvents by chemical washing. HEINRICH WIESENTHAL. *Chem.-Ztg.* 51, 373 (1927).—The app. made by the Cheminova (German) firm, for the recovery of alc. and ether from *artificial-silk processes*, is described briefly. Vapor-contg. air is filtered to remove dust and then passed through several scrubbing towers. The resulting liquid is then fractionally distld. J. H. PERRY

Emulsifying medium. G. M. WILLIAMS. *J. Soc. Dyers Colorists* 43, 296 (1927).—The medium employed is known as Amoa, and is the product of the action of KOH on pure casein under the influence of heat, among other substances, polypeptides being formed. The applications of Amoa to the making of emulsions of a large variety of substances are described. L. W. RIGGS

The trickling condenser. J. HUBER. *Arch. Wärmewirt.* 8, 75–9 (1927).—A detailed elementary mathematical discussion of trickling condensers for refrigerating plants. ERNEST W. THIBLE

High-pressure oxygen and nitrogen plants of small power consumption. V. FISCHER. *Z. Ver. deut. Ing.* 71, 1059–63 (1927).—Theoretical calcns. are made on the small-scale sepn. of O_2 and N_2 from air, using a 3-stage air compressor, a N cycle, a precooler and an expansion engine. Considerable exptl. data are given on the practical operation of such a small unit. J. H. PERRY

Technical aerosols and their properties. P. BEYERSDORFER. *Kolloid-Z.* 42, 229–33 (1927).—The complex problems of dust explosions are omitted in this discussion. Any combustible dust brought into the sol. condition is explosive while an aerogel must

first pass into the sol. condition. Studies were made of S and sugar mixts. and of air, carbon dust and CH_4 . Problems in metallurgy, dust precipitators, refractories, blast-furnace gas, coal-tar vapor and many others are briefly mentioned. Combustion in motors and reclamation of aerosols and further industrial problems are described.

R. H. L.

Slide rule for pipe computations. H. BEHRENS. *Gas u. Wasserfach* 70, 905-10, 930-2(1927).—A slide rule is described which facilitates the computation of pipe sizes, friction losses, etc., for water, steam, air and gas.

R. W. RYAN

Heat transfer in the condensation of saturated and superheated steam. H. CLAASSEN. *Centr. Zuckerind* 35, 129-217(1927).—STENDER. *Ibid* 190-1. SCHIEDD. *Ibid* 218. DELVENE. *Ibid* 218 9(1927).—Polemic.

W. L. BADGER

Heat transfer in furnaces with ceramic muffles. H. REPKY. *Arch. Warmewirt.* 8, 101-5(1927).—A method of calcn. is discussed in detail.

ERNEST W. THIBLE

Waste heat utilization. CHAS. F. WADE. *Brit. Clayworker* 36, 163-5(1927).—The subjects covered are (1) sources of waste heat; (2) conditions for max. economy; (3) engine adjustments; (4) utilization of surplus exhaust; (5) reducing steam consumption; (6) application of hot air in the brick industry.

R. A. HEINDL

Heat transmission by radiation from non-luminous gases. H. C. HOTTEL. *Ind. Eng. Chem.* 19, 888-94(1927).—The radiation from CO_2 and H_2O at different temps. is plotted, and consts. are derived for the absorption from these gases by various phys. arrangements of the cold body. The results are arranged in charts which make possible actual calcns. for specific boiler or furnace construction. Illustrative problems are solved, but the data cannot be assembled in an abstr.

W. L. BADGER

Conductivity methods of measuring condenser leakage. H. C. PARKER AND W. N. GREEK. *Power* 66, 476-81(1927).—The conductance of a condensed steam sample, of the condensate and of a 1% soln. of circulating water suffice to det. the rate of condenser leakage. The app. necessary for these measurements is described.

D. B. D.

Periodical report on war gases. A. KONOWALOW. *Z. ges. Schiess-Sprengstoffw.* 22, 122(1927).—K. describes recent chem. warfare developments in England, the U. S. and France. In England a comm. has been formed to take charge of chem. warfare. The War Department, the Marine Corps and the Air Corps are represented on the comm. which likewise includes 10 chemists, scientists and representatives of the chem. industries. In America there is difficulty in retaining experienced chemists in the War Department on account of the higher salaries paid by the chemical industries. Emphasis is placed on developments which have peacetime uses. Research is being done on the perfection of the gas mask and on the dispersion of smokes from airplanes. In France a comm. on gas defense has been formed under the leadership of the Ministries of Defense, Commerce and Industry. Its duties consist in the establishment of such industries as can be readily converted to war purposes.

J. S. REICHERT

War gases. PAUL PASCAL. *Z. ges. Schiess-Sprengstoffw.* 22, 155-6(1927).—P. divides war gases into the following classes: asphyxiating and lethal, lachrymatory, vesicant, sternutatory, emetic and smoke-producing. French war-time production figures for war gases are given and gas cloud attacks are discussed.

J. S. REICHERT

Gas defense. AUGUST SCHRIMPF. *Z. ges. Schiess-Sprengstoffw.* 22, 118(1927).—An introduction to a new section on gas defense describing its purpose and scope.

J. S. REICHERT

The development of gas defense since the World War. ULRICH MÜLLER. *Z. ges. Schiess-Sprengstoffw.* 22, 118-20(1927).—M. gives a brief review of the development of the gas mask.

J. S. REICHERT

Industrial gas masks. RUDOLF HANSLIAN. *Z. ges. Schiess-Sprengstoffw.* 22, 150-2(1927).—For every existing industrial need a reliable gas mask is available. The mouth respirator affords no protection for the eyes but with the proper chem. filling in the canister it will give adequate protection against vapors of org. solvents, acid fumes, NH_3 , HCN , H_2S and dusts such as are produced in the alkali industry, in sand-blasting, in paint spraying, etc. The adsorptive capacities of the various types of chem. fillings for the replaceable snout canister of the German army type mask are: Type A, 22.5 g. acetone, 10.5 g. benzene; Type B, 7.5 g. phosgene, 6.1 g. HCl , 6.1 g. oxides of nitrogen; Type E, 20.5 g. SO_2 , 20.5 g. HCl , 8.3 g. oxides of nitrogen; Type F, 8.4 g. Cl , 0.34 g. NH_3 , 3.3 g. H_2S , 0.6 g. chloropicrin, 3.45 g. SO_2 ; Type G, 2.5 g. HCN ; Type K, 2.9 g. ammonia; Type L, 4.5 g. hydrogen sulfide; Type M, 1.2 g. H_2S , 2.4 g. NH_3 ; Type O, 13.1 g. PH_3 , 12.6 g. AsH_3 . Protection against mists and smokes requires a larger canister, which is carried on the chest or the back. A special chem. filling (*Hopcalite*) is required for protection against CO. A warning agent is used in the canister to indicate the break-point against CO. The universal canister contains the required chemical

filing to protect not only against CO, illuminating gas, water gas, producer gas, blast-furnace gas, stack gas, suffocating gases resulting from explosions of fire and coal dust, provided the oxygen supply remains sufficiently high, but also against vapors of org. solvents, acid fumes, Cl , NH_3 , H_2S and AsH_3 .

Electrical resistivity of insulating materials. H. L. CURTIS. *J. Am. Inst. Elec. Eng.* 46, 1095-1103 (1927). J. S. REICHERT C. G. F.

Electrical insulating materials. A. GÜNTHERSCHULZE. *Z. Elektrochem. angew. physik Chem.* 33, 360-9 (1927).—A review of the general theory of dielectrics, and peculiarities of gaseous, liquid and solid insulators. Specifications are given for transformer oil and for solid com. insulators. D. GORDON

Soft rubber filter-press plates and frames (FRITZ, CLARK) 30. Insulating paper (Brit. pat. 262,828) 23.

HANSLIAN, RUDOLF: *Chemical Warfare*. Berlin: E. S. Mittler & Sohn. Revised and enlarged edition. 450 pp. 17 M. Reviewed in *Z. ges. Scheiss-Sprengstoffw.* 22, 157 (1927); cf. C. A. 21, 3404. J. S. REICHERT

Treating liquids. W. EVANS. Can. 274,013. Sept. 20, 1927. A process of treating liquids, e. g., softening water, consists in mixing in aq. soln. lime, Na_2CO_3 , and $\text{Na}_2\text{Al}_2\text{O}_4$, and then mixing the resultant product with the liquid to be treated. The resultant ppts. are sepd. from the liquid.

Treating liquids. W. EVANS. Can. 274,014. Sept. 20, 1927. Lime and Na_2CO_3 are mixed in aq. soln., then the product is mixed with the liquid to be treated, and $\text{Na}_2\text{Al}_2\text{O}_4$ is added. The resultant ppts. are sepd. from the liquid.

Purifying liquids. UDDEHOLMS AKTIEBOLAG. Swed. 63,515, Aug. 16, 1927. The liquid to be purified is mixed with sulfite cellulose waste liquor in the liquid state after which the purified liquid is sepd. from the impurities by decantation, distn. or another suitable procedure.

Alumina-containing coagulant for clarifying liquids. H. M. SPENCER. U. S. 1,643,962, Oct. 4. A concd. soln. is formed contg. alumina and sufficient SO_3 to effect peptization of the alumina.

Heating gases or liquids. A. HALLBÄCK. Swed. 63,569, Aug. 23, 1927. A part of the gases giving off heat after having passed through the heating app. is again introduced into the app. in order to reduce the temp. of the gases to the desired value.

Drying gases. W. MÜLLER. U. S. 1,644,439, Oct. 4. A soln. of P_2O_5 in H_3PO_4 is used for drying air or other gases.

Discharging carbon dioxide under high pressure. C. L. JONES. U. S. 1,644,338, Oct. 4. The greater part of the pressure drop is localized at a constricted discharge orifice, and the passage leading to the orifice is thermally insulated from the cooled expanded stream of CO_2 emerging from the orifice, to prevent stoppage of flow.

Separating an emulsion or a colloidal solution into its components. B. JOHNSON. Swed. 62, 678, March 29 (1927). The emulsion or colloidal soln. is intimately mixed with a carboxylic acid which is sol. in the disperse substance but insol. or only slightly sol. in water.

Separating crude shellac solutions or other liquids from suspended matter centrifugally. F. C. RAWOLLE. U. S. 1,644,492, Oct. 4.

Composition for generating irritant fumes for defensive or offensive purposes. J. A. PRENTICE. U. S. 1,643,954, Oct. 4. A smoke-generating ingredient such as SnCl_4 is used together with bromobenzyl cyanide or xylol bromide or other irritant and a persistently odorous substance such as Bu mercaptan.

Vacuum refrigerating system using dichloroethylene as a refrigerant. W. H. CARRIER and CARRIER ENGINEERING CORPORATION. Brit. 263,052, Aug. 11, 1925.

Working fluid for refrigerating apparatus. A. A. KUCHER. U. S. 1,645,198, Oct. 11. A soln. comprising EtCl and a mineral oil is used.

Insulating material. A. U. WESTFELT. Swed. 62,702, June 8, 1927. A porous insulating material is produced by mixing water glass with a gas-forming substance, for instance KClO_3 or other suitable materials, and drying and heating the mixt.

Heat- and sound-insulating material. W. E. NELSON and T. B. HENNESSEY. U. S. reissue 16,753, Oct. 4. A sheet of unsatd. felt has a layer of asphalt on its face forming a surface adapted to receive plaster.

14—WATER, SEWAGE AND SANITATION

EDWARD BARTOW

Mineral waters of Loutraki. EM. EMMANUEL. *Arch. Pharm.* **265**, 550-4(1927).—The waters of this region (opposite Corinth) are oligometallic, being divided into 2 groups, as alkaline salt springs taken largely for curative purposes, and alkaline magnesia springs which furnish the municipality with drinking water. Water of the first group was clear, colorless, odorless, had a mild salty taste and the following characters: temp. 31.45°, d_{18} 1.0016, freezing-pt. depression 0.125, elec. cond. K_{18} 0.00351, radioactivity 10.39 Mache units. Chem. compn.: alky. in terms of NaHCO_3 0.1008 g. per kg., total residue 2.1562 g. SiO_2 0.0147%, CO_2 (free) 0.02685 g. per kg. = 13.67 cc. under normal temp. and pressure. The compn. as calcd. from the various ions detd. is: NaCl 1.24268, NaHCO_3 1.14076, K_2SO_4 0.00946, MgCl_2 0.34720, $\text{Ca}(\text{HCO}_3)_2$ 0.18529, CaSO_4 0.20689, $\text{Fe}(\text{HCO}_3)_2$ 0.00084, $\text{Al}_2(\text{SO}_4)_3$ 0.00839, H_2SiO_3 0.01470, with traces of Li, Mn, Br, I, nitric and phosphoric acids. Water from the 2nd group was clear, colorless and odorless, and possessed a peculiar sweetish taste. It had a temp. 19.5°, d_{18} 0.9990, freezing-pt. depression 0.020, elec. cond. 0.00088, radioactivity 0.813 Mache units. Chem. compn.: alky. in terms of NaHCO_3 0.2352 g. per kg., total residue 0.4468%, SiO_2 0.0150 g. %, CO_2 (free) 0.0342 g. per kg. = 17.41 cc. under normal temp. and pressure, N-free org. material 0.011%, hardness (German) 23.22° (French) 41.46°. Compn. calcd. from the ions is KHCO_3 0.00705, NaHCO_3 0.09797, $\text{Mg}(\text{HCO}_3)_2$ 0.53836, MgSO_4 0.00785, MgCl_2 0.01454, CaCl_2 0.02758, $\text{Fe}(\text{HCO}_3)_2$, $\text{Al}_2(\text{SO}_4)_3$ 0.00201, H_2SiO_3 , traces of Li, Mn, nitric and phosphoric acids, and org. material.

W. O. E.

The springs of Bad Salzhausen. FRITZ FENSSLIN. *Notizblatt ver. Erdkunde Hess Geol. Landesanst. Darmstadt* **1925**, 251-5; *Chem. Zentr.* **1926**, II, 1006-7.—The sinter which is deposited in the open around the NaCl springs was examd. As, Pb, Zn, Mn and PO_4 were detected for the first time. From the analyses, certain conclusions regarding the origin of the springs and their connection with those of Bad Nauheim are drawn.

C. DAVIS

Further contributions to river-water control. JULIUS ZINK AND FRIEDRICH HOLANDT. *Z. angew. Chem.* **40**, 1062-4(1927).—To explain the fate of Mg salts thrown into river water and then disappearing, expts. were conducted with clays and clay-soils. The disappearance of the Mg and formation of Ca compds. in the water is ascribed to the presence of zeolite-like substances in the clays used. This exchange of bases is, therefore, the reason for the alteration in the salt content of river water.

W. C. EBAUGH

Report of an investigation of the pollution of Lake Michigan in the vicinity of South Chicago and Indiana Harbors. ANON. *U. S. Pub. Health Service, Pub. Health Repts.* **42**, 2200-2(1927).—Sewage and trade waste from the Calumet district discharged into Lake Michigan render the sources of water supply of Hammond, Whiting and E. Chicago unfit for such use and seriously pollute the supply of Gary. The Chicago intakes at Dunne and 68th streets are endangered at times. North of these points only Waukegan and Lake Forest are endangered. If this is to remain a source of water supply for Chicago and nearby towns existing pollution should be abated. F. D. S.

Stream pollution in Wisconsin. C. M. BAKER, L. F. WARRICK, E. J. TULLY, O. J. MUEGGE, J. P. SMITH AND C. L. TURNER. *Paper Trade J.* **85**, No. 10, 43-7(1927).—A joint report of the Conservation Commission and State Board of Health of Wisconsin concerning activities in the control of stream pollution, from July 1, 1925 to Dec. 31, 1926. Preliminary investigation with samples of sulfite waste liquor indicated that its O demand can be reduced approx. 50% by forcing air into it through the pores of a basswood block, apparently confirming the opinion that a large part of the initial demand is direct chem. oxidation of the unstable constituents. The O demand for periods from 12 hrs. to 5 days can be reduced 76-92% by ponding (storing in an open reservoir or pond) and aeration. Cooling and settling of the waste liquor in the storage reservoir is much more effective in reducing the O demand than aeration over a cascade spillway. It is believed that the initial O demand, or that responsible for the immediate depletion of O in a stream just below a sulfite mill, is materially, if not completely, satisfied during the 2-3 days settling period. The report covers a study of the chief streams of Wisconsin as to the degree of pollution, the main source of which is the pulp and paper industry.

A. PAPINEAU-COUTURE

Inspection of water supplies and sewerage systems. A. E. BERRY. *Pub. Health J. (Can. Pub. Health Assocn.)* **18**, 339-42(1927).—A general discussion. R. E. T.

A problem of municipal water supply in the oil fields. F. M. VEATCH. *Eng. News-Rec.* 99, 394-5(1927).—A description of the new water supply system of El Dorado, Kans., which consists of an impounding dam on Satchel Creek, a 24-in. cast iron flow line and a clear water reservoir. The water will be delivered to the existing 2-m. g. d. filtration plant constructed for the purification of the former supply from Walnut River which had to be abandoned owing to oil waste pollution. R. E. THOMPSON

The examination and judging of water. W. APPELIUS. *Ledertech. Rundschau* 19, 81, 93-9, 111-5(1927).—Outline and methods for water analysis are given. I. D. C.

Glaucinite in water softening. R. H. FIMERICK. *Power* 66, 401(1927).—Glaucinite is prepd. from greensand by cleaning, screening and color fixing. It usually delivers water having a hardness not in excess of 10 to 12 p. p. m. in terms of CaCO_3 . Glaucinite does not belong to the zeolite group. D. B. DILL

Water softening in the home. EDWARD BARTOW. *Proc. Iowa Acad. Sci.* 33, 165-8(1926).—A brief popular discussion of the lime soda process and the base exchange or zeolite process of treating water in the home to improve its condition. W. G. G.

Intermittent lime feed plan reduces incrustation from softened water. L. C. BILLINGS. *Eng. News-Rec.* 99, 70(1927).—Intermittent lime treatment at the 40-m. g. d. plant at Grand Rapids, Mich., has materially reduced carbonate incrustation of mains from lime-softened water and has permitted a reduction in the amt. of lime used. The raw water hardness, which is 14 grains per gal., is reduced 50% by the treatment, which accomplishes the same results as the "split treatment" method, although the resulting water is 2-3 grains per gal. harder than when full lime treatment is employed. R. E. THOMPSON

Settling basin for water works of Lawrence, Kansas. WYNKOOP KIERSTED. *Eng. News-Rec.* 99, 65(1927).—Illustrated description of the recently completed settling basin at Lawrence which consists of 4 compartments for (1) natural sedimentation, (2) mixing and application of chemicals, (3) chem. reaction and (4) final sedimentation, the retention periods at the rated capacity of 3 m. g. d. being 2 hrs., 21 min., $\frac{1}{2}$ hr., and $3\frac{1}{2}$ hrs., resp. The water is delivered into the coagulation compartment through a series of vertical slots 5 ft. high, with a width beveled outward from $\frac{1}{2}$ to 2 in. The preliminary and coagulation basins are double hopper bottomed, provision being made for drawing off sludge without disturbing the main valve. R. E. THOMPSON

The treatment of beet flume and washer waters. PAUL HIRSHFELDER. *Centr. Zuckerind.* 35, 273-4(1927).—Such waters may be treated by (A) simple settling basins. The first cost is small, but the cost of sludge disposal is heavy, and trouble is experienced because of putrefaction in the sludge. (B) The waste water may be pumped into fields, which are used for cultivation after a layer of sludge has built up. This involves heavy charges for land, and the results are not satisfactory, because of the settling of sand in the nearer areas. (C) Small settling basins with continuous sludge removal may be used, and the heavy sludge formed pumped to waste land. This is often satisfactory, especially where the sludge need not be pumped far. (D) Where sludge must be transported over 2 kilometers, a settling basin with a slow-moving rake should be used to produce a sludge of not over 10-15% solids. This may be pumped without undue expense and without danger of sand settling out. W. L. BADGER

An experience with manganese in textile water. C. F. GOLDTHWAIT. *Am. Dyestuff Rept.* 16, 605-8(1927).—Mn is more frequently present in a municipal water supply than is commonly supposed, and, if not removed, occurs as weak as 1 part per million cause trouble on coming in contact with textiles. In the case studied Mn was removed by the addn. of FeSO_4 as a coagulant to the city supply before reaching the filters. L. W. RIGGS

Taf Fechan impounding reservoir and works. THOS. F. HARVEY. *Water and Water Eng.* 29, 309-17(1927).—The Taf Fechan reservoir: its inception, gagings, yield, embankment and cut-off trench, overflow shaft, valve tower, filtration plant, clear water tank, pipeline and break-pressure tank are fully described. J. A. KENNEDY

Effluent aerators control mechanical filters. MALCOLM PIRNIE. *Eng. News-Rec.* 99, 376-80(1927).—Effluent aerators at the Providence, R. I., West Palm Beach, Fla., Poughkeepsie, N. Y., and Rahway, N. J., filter plants are described and the results attained are tabulated. As a result of aeration the p_H values of the waters are increased 0.2-0.3 and the CO_2 contents reduced 1-7.5 p. p. m. R. E. THOMPSON

The applicability of the determination of sulfuric acid by means of benzidine to water analysis. L. W. HAASE. *Chem.-Ztg.* 51, 637-8(1927).—Data from which the conclusions published in a previous paper (C. A. 21, 2235) were drawn are now given in fuller detail. W. T. H.

Rapid determination of carbon dioxide in water. LENNART SMITH AND GUNNAR

WODE. *Svensk Kem. Tids.* 39, 63-74(1927).—The titrations of free CO_2 with phenolphthalein, HCO_3^- with Me orange, and estg. total CO_2 by a scheme of acidifying, evacuating and fixing with Ba (A. Westerberg, *Svensk Tekn. Tids.* 40, 49(1910)) are discussed at length. Tests of free CO_2 by titration, total CO_2 minus Me orange titration, and by Westerberg's indirect method are compared with the calcd. values from complete water analysis. The first two series agree very well but the last does not. The Me orange titration and Westerberg's indirect HCO_3^- method are compared with HCO_3^- calcd. from complete analysis and both agree within 5% error. The sum of phenolphthalein and Me orange titrations is in good agreement with the total CO_2 values detd. by the above method. A. R. ROSE

Iodine and goiter in Utah and use of the Cottrell precipitator in iodine analysis. J. F. MCCLENDON. *Proc. Soc. Exptl. Biol. Med.* 23, 494-6(1926).—In a given community the I content of water varies. A low I content is assocd. with a high incidence of goiter among school children. A modification of the Cottrell precipitator for I analyses is described. C. V. B.

Aerobic spore-forming bacilli which ferment lactose. S. A. KOSER AND W. C. SHINN. *J. Am. Water Works Assocn.* 18, 328-36(1927).—Describes work done in an effort to identify such forms. *B. asterosporus* has the proper characteristics. The water analyst should recognize and guard against such forms. D. K. FRENCH

Brilliant green bile for the detection of the colon-aerogenes group. H. E. JORDAN. *J. Am. Water Works Assocn.* 18, 337-46(1927).—Following much investigation parallel planting in lactose broth and brilliant green lactose bile is recommended. The following new terms are explained: "partially confirmed," "double presumptive," "confirmed coli," and "confirmed aerogenes" D. K. FRENCH

Preventing incrustation of pipe lines in lime-soda treatment. WM. M. BARR AND H. W. FAUS. *Railway Engineering and Maintenance* 23, No. 6, 257(1927).—Municipal practice of introducing CO_2 into the treated water is not practical for steam-plant service. Sodium aluminate appears to give best results. R. C. BARDWELL

Cutting the cost of water treatment \$2.27 per 100,000 gallons. C. R. KNOWLES. *Railway Engineering and Maintenance* 23, No. 5, 211(1927).—Illinois Central Railroad has reduced the treatment expense by recovering filter wash water and less sludging loss with conical bottom tank. Construction details for chem. app. housing and pressure filter are shown. R. C. BARDWELL

Self-damping gage for determining heads in pipe lines. D. S. ELLIS. *Eng. News-Rec.* 99, 478(1927). R. E. THOMPSON

The ideal water pipe. The supply of pure water for human consumption and the method whereby it can be obtained. S. DICKSON. *Water and Water Eng.* 29, 323-4(1927).—After stating why most pipes fail to meet the ideal, D. concludes that a metal pipe lined with cement mortar by the centrifugal method is ideal. This combines the properties of the "stony gathering ground" with long length and few joints, plus the added properties of great strength, resistance to shock, and a denseness of lining of extraordinary quality. The lining also protects the metal from corrosion. J. A. K.

Boiler water tests should be utilized. I. C. E. JOOS. *Power Plant Eng.* 31, 769-71(1927).—Description of app. and methods for making hardness and chloride detns. in boiler feed water. II. *Ibid* 895-7.—The analyses form the bases for checking leaky blow-off valves and broken baffles and for detg. scale removal or formation while boilers are in operation. S. D. POARCH

Scaling of boilers by softened water. Method of prevention. P. LE TELLIER AND H. SUNDER. *Paper Industry* 9, 793-5(1927); *Paper Maker and Brit. Paper Trade J.* 74, 255, 259(1927).—See C. A. 21, 785. A. PAPINEAU-COUTURE

The theory of boiler-scale formation. R. STUMPER. *Arch. Wärmewirt.* 8, 271-5(1927).—S. discusses scale formation from a phys. chem. viewpoint, and reports the results of expts. showing that the thermal decompn. of Ca and Mg bicarbonates in soln. is monomol. ERNEST W. THIELE

Sewerage and sewage treatment with particular reference to the activated-sludge process. HERBERT E. BELLAMY. *Commonwealth Eng.* 15, 32-4(1927).—A review. FOSTER D. SNELL

Modern methods of sewage disposal. W. M. VEITCH. *Contract Record Eng. Rev.* 41, 754(1927).—A general discussion. R. E. THOMPSON

Schenectady sewage chlorination studies, 1926-7. M. M. COHN. *Eng. News-Rec.* 99, 229-31(1927). cf. C. A. 20, 3763.—Additional observations on chlorination at the Schenectady sewage works are given. Parallel tests of raw sewage and Imhoff tank effluent indicated that the Cl_2 demands were practically the same. There was a marked improvement in the odor of the effluent from Imhoff tanks treating sewage

chlorinated at the rate of 4-6 p. p. m., although no residual Cl_2 could be detected after the sewage had entered the tanks. The H_2S content was greatly reduced, and although H_2S was never absent, no septic odor was ever noted. The biochemical O_2 demand of the effluent was 27% less than that from untreated sewage. No deleterious effect on sludge digestion was observed. The odor of the sludge from tanks receiving treated and untreated sewage has been similarly slight, the consistency of the former being somewhat heavier, the color somewhat darker and the org. matter content slightly lower. Expts. by G. M. Fair indicated that the chlorinated solids digest more rapidly and that CH_4 production at the end of 2-3 weeks is practically twice as great. Application of 25 p. p. m. Cl_2 to tank effluent applied to sprinkling filters for a 48-hr. period removed the heavy gelatinous film on the surface of the media and decreased the no. of *Psychoda alternata* present. Similar treatment for 24-hr. periods at 2-week intervals resulted in a decrease in fly life in the majority of instances. The immediate effect of chlorination was a sudden drop in stability and oxidized N content of filter effluent, probably due to marked unloading. Nitrification increased to normal about a week after treatment and was fairly satisfactory during the balance of the period before the next chlorination. The filter effluent stabilities during the winter of 1926-7, following intensive chlorination during the summer months, were higher than during the previous winter and the oxidized N content was equally high. Fly exterminations with *o*-dichlorobenzene has been continued as routine procedure with marked success. A mixt. of equal parts of *o* dichlorobenzene and kerosene has been found just as effective. R. E. THOMPSON

Operation of sewage works of Pontiac, Mich. J. R. POLLOCK. *Eng. News-Rec.* 99, 434-5 (1927).—Brief data are given on the operation of sewage works of Pontiac, which consists of a grit chamber, Imhoff tanks, sprinkling filters, secondary tanks and a sludge drying bed. The effluent is discharged into the Clinton River, which provides dilution of not more than 0.3 sec.-ft. per 1000 population. The normal dry weather flow is 3.8 m. g. d. The cost of operation during 1925 and 1926 was, resp., \$0.152 and \$0.167 per capita or \$5.44 and \$6.00 per m. g.

R. E. THOMPSON

Experiences in destroying sewage screenings by burning. R. A. APPLETON. *Eng. News-Rec.* 99, 500-2 (1927).—The screenings from the two 12-m. g. d. Dorrco screens at Long Beach, Cal., are destroyed by incineration, natural gas being used as fuel. The screenings removed on the av. 30.7 cu. ft. per m. g. During 1925 6 an av. of 105.8 cu. ft. of gas was consumed in incinerating each cu. ft. of wet screenings and the av. total cost of incineration was 4.025¢ per cu. ft. The temp. in the combustion chamber varied between 1561° and 1690° F. An analysis of the ashes removed, which varied from 0.5 to 1.15% of wt. of screenings burned, showed: SiO_2 , 46.14; P_2O_5 , 10.82; K_2O , 2.85; and Na_2O , 1.82. No complaints of nuisance have been received. R. E. THOMPSON

Replacing wood-stave outfall sewer with concrete at El Paso. ROBT. P. ANDERSON. *Eng. News-Rec.* 99, 175-6 (1927).—Description of 36-in. concrete outfall sewer built to replace a wood-stave line which was approaching failure due to rusting of iron bands, to action of gases on the top part of the staves and to rotting on the outside of the bottom staves. The iron bands appeared to have failed where gas was escaping through the pipe. The pipe was of Alamogordo pine, 1070 ft. long from septic tanks at El Paso, Tex., to the Rio Grande. The septic tanks consist of 15 compartments which are used in succession as digestion proceeds, the av. flow being 6 m. g. d. and max. flow 12 m. g. d.

R. E. T.

Sewage chlorination beneficial at Singapore. A. G. HARRINGTON and C. E. WHITTAKER. *Eng. News-Rec.* 99, 238 (1927).—The Singapore sewage works include a roughing screen, detritus tanks, Imhoff tanks, filters and humus tanks. Chlorination of the filter influent was experimented with in an attempt to eliminate ponding, 2 p. p. m. Cl_2 being applied for 8 hrs. each day. The treatment reduced the free NH_3 content of the effluent from 12 to 6 p. p. m., the O_2 absorbed from 13 to 6 p. p. m. and the suspended matter from 35 to 20 p. p. m., and increased the nitrates from 6 to 15 p. p. m. There was no reduction in the gelatinous film, but ponding was slightly decreased. Chlorination at the rate of 3 p. p. m. for 8 hrs. each day or at 2 p. p. m. continuously was not as effective.

R. E. THOMPSON

New sewage treatment plant at Wichita Falls, Texas. JULIAN MONTGOMERY. *Water Works* 66, 289-90 (1927).—The plant which is designed to treat 3 m. g. p. d. of domestic sewage from a sep. system consists of pumping station, screen and grit chamber, four Imhoff tanks, sludge drying beds, dosing tanks, trickling filters and a Dorr equipped secondary settling tank.

C. C. RUCHHOFF

Results from Passaic Valley sewer. ANON. *Public Works* 58, 210-3 (1927).—The Passaic Valley intercepting sewer has increased the percentage satn. of dissolved O in the Passaic River from 14% during its first year of operation to just under 25%

during its second year. The percentage satn of dissolved O has been increased at all points in Newark Bay and conditions in the sewage diffusion area in New York Bay are no worse than formerly.

Sewage plant records. J. R. DOWNES. *Water Works* 66, 335-6(1927).—The O demand, suspended solids and the p_{H} detns. are recommended as the best tests for routine sewage plant control.

The fate of *B. coli* and *B. aerogenes* in sewage purification. H. HEUKELKIAN. *J. Bact.* 14, 55-67(1927).—It is probable that the colon group is mainly responsible for the decompn. of available carbohydrates giving rise to high acidity which checks its own numbers.

Production of illuminating gas from the Stuttgart Sewage filter plant. W. SOMMER. *Gas u. Wasserfach* 70, 945-9(1927).—A daily gas production of 3000 4000 cu. m. of gas is obtained from the anaerobic fermentation of sludge from the S. sewage (population of Stuttgart 350,000). The gas analyzes about 12 to 20% CO_2 , 4.8% H_2 , 75.5% CH_4 , and 4.7% N_2 , and has a calorific value of 7500 to 8500 cal. per cu. m. The method of recovery of this gas is described and illustrated. The gas is sold to the Gaisburg gas works.

Measurement of atmospheric pollution, visible and invisible. G. T. MOORE. *Mech. Eng.* 49, 1067-8(1927).—The methods for solid matter include "soot-fall," Owens automatic air filler and a jet dust counter. Acid is measured by the cond. of water exposed to the air sample. Germs are collected by drawing air through sterile sand, extg. with water and plating out. A characteristic salivary organism serves as indicator in the same way as *B. coli* indicates sewage pollution.

Garbage and refuse disposal at Fort Dodge, Iowa. BYRON BIRD. *Water Works* 66, 235-9(1927).—Refuse is disposed of in municipal dumps and garbage is incinerated in a plant that is described in detail.

Treating liquids (Can. pat. 274,013) 13.

MARTIN, ARTHUR J.: **The Activated Sludge Process.** London: Macdonald and Evans. Cloth. 415 pp. 30s. net. Reviewed in *Eng. News Rec.* 99, 111(1927).

TEMPLE, E. C.: **Sewage Works.** London, Eng.: Crosby Lockwood & Son. Cloth: 67 pp. 5s. net. Reviewed in *Eng. News-Rec.* 99, 277(1927).

Softening water. W. H. GREEN. U. S. 1,644,469, Oct. 4. Hard H_2O is continuously passed upwardly through a portion of a bed of zeolite, and a regenerating soln. is intermittently passed downwardly through another portion of the bed; the regenerating soln. is washed out, and particles of the bed are transferred from 1 portion to the other. An app. is described.

Apparatus for softening water. C. P. EISENHAEUER. U. S. 1,644,714, Oct. 11.

Deaerating water by exhaust steam. G. H. GIBSON. U. S. 1,645,132, Oct. 11.

Water-carbonating apparatus. WM. C. DEARMOND and WM. R. H. WATT. U. S. 1,645,320, Oct. 11.

Preventing incrustation in boilers. H. KOPPLINGER. Brit. 262,823, Dec. 14, 1925. Protective colloids and finely divided resins and essential oils or their constituents are used for preventing or removing incrustation; e. g., colophony 100, resin soap 4 and essential oils 10 parts.

Coated water pipe. B. TALBOTT. U. S. 1,644,360, Oct. 4. A protective coating which may be formed of cement or asphalt compds. is keyed onto pipe formed of steel or Fe plate by an impressed pattern.

Septic tank. H. A. LEDYARD and J. J. JELLEY. U. S. 1,644,532, Oct. 4.

Septic tank. WM. ROSE. U. S. 1,645,116, Oct. 11.

15—SOILS, FERTILIZERS AND AGRICULTURAL POISONS

J. J. SKINNER

Chemistry and agriculture in their mutual relations. F. HONCAMP. *Z. angew. Chem.* 40, 1043-9(1927).

Advances in agricultural microbiology. TRAUGOTT BAUMGÄRTEL. *Z. angew. Chem.* 40, 1049-52(1927).

Woodford county soils. R. S. SMITH, E. E. DETURK, F. C. BAURER and L. H. SMITH. Univ. Ill. Agr. Expt. Sta., *Soil Rept.* No. 36, 57 pp.(1927).—The soils of the

county are classified and chem. analyses showing the content of essential plant food elements in each of the important types given. M. S. ANDERSON

Lee County soils. R. S. SMITH, O. I. ELLIS, E. H. DETURK, F. C. BAUER AND L. H. SMITH. Univ. Ill. Agr. Expt. Sta., *Soil Rept.* No. 37, 65 pp. (1927).—A classification of soil types and chem. analyses of each are given. M. S. ANDERSON

Soil survey of the Artibonite plain. E. O. PIPPIN. Rep. Haiti Service Tech. Dept. Agr., *Bull.* No. 5, 5-210 (1926).—Examn. of 50 soil horizons from the Artibonite plain of Haiti shows the majority to be of high clay content. The sp. grs. of these soils are very low compared with similar data of the soils of temperate regions, ranging from 2.30 to 2.56 with an av. of 2.37. The soils all have a high lime content, varying from 7.5 to 82%. The av. is 32% CaCO_3 . The av. SiO_2 content is about 39%. N and org. matter are, as a rule, higher than in American soils, and the K and P content is somewhat lower. More than half of the soils analyzed had a K_2O content of less than 1.0%. In view of the low availability of the K this quantity must be considered as inadequate. P treatments are suggested for improving the availability of the K. The subsoils show about the same plant food deficiencies as the surface soils. 52% of the land contains less than 0.2% alkali salts. 24% is moderately charged, contg. 0.2 to 2.0% and 24% of the soils contain more than 2.0% of sol. alkali salts. About 65% of the total area is considered suitable for cultivation. Water exts. of the soils are for the most part neutral in reaction although a few contain small quantities of Na_2CO_3 . Cl and HCO_3 anions predominate. The river waters carry an av. total-solid content of about 200 p. p. m., most of which is bicarbonates. M. S. ANDERSON

Biochemical methods for determining assimilable quantities of potash, phosphorus and nitrogen in soil. I. The method of Neubauer and Schneider. STANISLAW HOLYNSKI. *Mém. Inst. natl. Polonais économie rurale Pulaaway* 7, 245-60; *Chem. Zentr.* 1926, II, 2482.—The limiting values given by Neubauer and Schneider were confirmed for soils from the region of Bydgoszcz. The exptl. plants had to be grown at 15-17° in diffused light. The wt. of the seedlings was less than that of the seeds used. There was less assimilated P present than in the seeds. On peat and clay soils, the water requirement of seedlings is greater than the data of Neubauer and Schneider. The method is regarded as a good qual. test of the nutrient requirements. C. C. D.

The determination of the salinity of soils from the electrical conductivities of their aqueous extracts. N. K. VOSKRESSENSKA. *Ann. inst. anal. phys. chim.* 3, 302-4 (1926).—No simple relationship was found between humin content and cond.

BASIL C. SOYENKOFF

The total sulfur content of arable soil. G. BERTRAND AND L. SILBERSTEIN. *Compt. rend.* 184, 1388-90 (1927).—Analyses of a no. of samples of French soils show that the proportion of S in cultivated soils varies within rather wide limits and sometimes drops to a very low value. The highest content was found in the Lower Seine region and the lowest in the Gard. The regions highest in S are among the most fertile. It is logical to assume that fertilizers contg. SO_4 are of benefit to soils very low in S. P. R. D. *

The determination of sulfur in arable soil. G. BERTRAND AND L. SILBERSTEIN. *Bull. soc. chim.* 41, 950-4 (1927); cf. preceding abstr.—A 5-g. sample of air-dried soil is digested for an hr. with occasional shaking in a Kjeldahl flask (approx. 200 cc.) on a water bath, with 15 cc. of redistd. fuming HNO_3 (d. 1.5). The contents are then transferred to a porcelain evapd. dish, a little water being used to remove remaining particles. (The digestion may be carried out directly in the dish by covering with a funnel whose diam. is slightly less than that of the dish.) The contents of the dish are evapd. on a water bath to the consistency of paste. A 10% soln. of Na_2CO_3 is then added, with stirring, from a graduated pipet, until cessation of effervescence (neutralization). About 6-10 cc. are required. A further vol. of the Na_2CO_3 soln., equal to that already used, is then added and the mixt. transferred to a 75-cc. Ni crucible. Approx. 10 g. of a powdered equimol. mixt. of NaNO_3 and Na_2CO_3 (or better KNO_3 and Na_2CO_3) are then added, the mixt. is evapd. to dryness on a water bath, and heated just to fusion in a small elec. furnace, the mass being stirred now and then with a large Fe or Ni wire. When the reaction is complete (CO_2 no longer evolved) the melt is cooled, taken up in water, transferred to a porcelain dish, treated with 20 cc. of concd. HCl and evapd. to dryness. The residue is again moistened with 10 cc. of HCl and evapd. This residue is moistened with HCl, more water added, filtered and the S detd. as BaSO_4 . It is absolutely necessary that all heating with gas be avoided, to prevent contamination with S. A series of results obtained on a garden soil are presented. The losses of S in calcining in air or in the presence of a mixt. of alk. NO_3 and CO_2 were found to be 41.4 and 13.1%, resp. Hence, these methods are subject to great error. Preexistent sulfates are detd. by extn. with boiling water acidified with HCl. Several repetitions

of the process are necessary. The org. S, including any free S, is detd. by difference.

P. R. DAWSON

Normal moisture capacity of soils. C. F. SHAW. *Soil Science* 23, 303-17(1927).—The normal-moisture capacity is the minimum quantity of H_2O retained by absorption and film forces when the H_2O is free to move downward through a uniform soil. With the soils of medium texture studied it is approx. the same as the moisture equiv. This water is available for plants but is essentially static.

R. BRADFELD

Maximum height of capillary rise starting with soil at capillary saturation. C. F. SHAW AND ALFRED SMITH. *Hilgardia* 2, 399-409(1927).—With a water table at a depth of more than 10 ft. below the surface, no losses by evapn. from the surface will occur from soils similar to Yolo loam or sandy loam. This conclusion is likewise probably applicable to sandy loams or loams in general.

CARL R. FELLERS

Colloidal behavior of soils and soil fertility. III. Cation replacement and saturation of soil with calcium. J. S. JOFFE AND H. C. MCLEAN. *Soil Science* 23, 127-35(1927); cf. *C. A.* 20, 2039.—A discussion of soil acidity problems from the cation replacement standpoint. The exchangeable H ion detd. by the complete neutral salt extn. methods gives with the New Jersey soils studied a better index to lime requirement than the methods more commonly used.

R. BRADFELD

The hydrometer as a new and rapid method for determining the colloidal content of soils. G. J. BOUYOUCOS. *Soil Science* 23, 319-31(1927).—A 50-100 g. sample of soil is dispersed in 1000 cc. of H_2O contg. 5 cc. N KOH by a motor-driven stirrer in a specially constructed cup for 9 min. After standing undisturbed for 15 min. the sp. gr. of the suspension is detd. and the colloid content calcd. The results obtained by this method show a fair agreement with those obtained by the heat of wetting method.

R. BRADFELD

The phenomena of contraction and expansion of soils when wetted with water. G. J. BOUYOUCOS. *Soil Science* 23, 119-26(1927).—The vol. change occurring when soils are mixed with water was measured with a dilatometer. In order to displace all air the soil was first mixed with CCl_4 . Water was then added on top of the layer of CCl_4 . The heavier liquid prevented contact of the soil with water until the latter had reached a const. temp. The water and soil were then brought into contact by tipping the dilatometer and the change in vol. which occurred was measured. Twenty soils, 3 soil colloids, muck, silica gel and fuller's earth were used. In all cases, a decrease in vol. was observed when wetting occurred, varying from 0.033 cc. per 100 g. soil for sand to 4.666 for muck. In general, the soils of high colloidal or high org. content gave the greatest contraction. The correlation between vol. of contraction and colloidal content was not as close as between vol. of contraction and heat of wetting. B. attributes the phenomena of contraction principally to the condensation of some of the water on the surface of the soil particles.

R. BRADFELD

Differences in heat of reaction between artificial and soil gels of silica, alumina and iron with hydroxides. G. J. BOUYOUCOS. *Soil Science* 23, 243-7(1927).—The heat developed when a series of soils and artificial gels was treated with 3 N NaOH and KOH was detd. The heat of reaction is defined as the difference between the total heat developed on treatment with alkalis and that developed when wetted with water. The heats of wetting of the soils and gels were of the same order of magnitude but the heat of reaction of the gels was much greater. This is attributed to a partial soln. of the gels by the alkalis.

R. BRADFELD

Organic matter changes in two soil zones, as influenced by differences in form, fineness and amount of calcic and magnesian materials. W. H. MACINTYRE, W. M. SHAW AND E. M. CRAWFORD. *Soil Science* 23, 107-17(1927).—In the first of 2 series of lysimeter expts., addns. of $Ca(OH)_2$ in varying amts., $CaO-MgO$, limestone and dolomite of varying fineness were made to only the surface zone of the lysimeters. In the 2nd series, the same addns. were made to the subsurface zone only. After 4 yrs.' exposure without crops and without stirring, the org. CO_2 in both zones of both series was detd. In the first series, the av. org. CO_2 of the surface zone was somewhat less than the control; that of the subsurface zone was the same as the control. Large variations in the amt. of $Ca(OH)_2$ added did not produce proportionately large variations in org. CO_2 content, and variations in fineness of limestone and dolomite did not produce marked differences in CO_2 content. In the 2nd series, the av. org. CO_2 of the surface zone was similar to the control, and no differences due to amt. or fineness of the subsurface addns. were observed; the av. CO_2 content of the subsurface soil was somewhat less than the control. No effect on the untreated zone was produced by treatment of the other, and the accelerative effects of liming were comparable in both zones.

R. BRADFELD

Decomposition of organic matter and changes in nitrification and absorption power of soils. A. F. TYULIN. *Trans. Sci. Inst. Fertilizers* 33, 5-78(1926).—The effects of lime on a podsolized soil were studied. As a source of org. matter a highly dispersed ext. of lupine, incubated for 30 days under aerobic condition, was used; 200 cc. of the ext. (the latter was prep'd. by treating the dry lupine after incubation with twice its weight of water and passing it through a linen cloth) were added to each kg. of soil. The amt. of lime equalled 1%. One series of pots was leached twice with dist'd. H_2O , 1 l. per kg. of soil. The total loss in org. matter after 6 months fluctuated from 10 to 14.5% in terms of C. The limed soils from the unleached pots lost from 5 to 8% more than the unlimed soil. The same tendency of losing org. matter upon the addn. of lime was noted when the lupine was added without any preliminary treatment. On a highly unsat'd. soil from pine forests lime (0.5% $CaCO_3$) without horse manure inhibited decompn. of org. matter. Higher amts. of lime (1% $CaCO_3$) increased the decompn. of org. matter. When the soil without manure was leached the addn. of 0.5% $CaCO_3$ increased the decompn., 1% decreased it. With manure (0.4% C) the 0.5 and 1% $CaCO_3$ decreased the decompn. of org. matter. With an increase of $CaCO_3$ the org. matter decompn. also increases. In the second part of the work T. discussed his expts. on the power of the sesquioxides to absorb nitrates chemically. He also showed that lime addns. in certain cases increased the absorption capacity of the soil. J. S. JOFFE

Disintegration of cellulose in soil. CHR. BARTHEL. *Svensk Kem. Tids.* 39, 221-32(1927).—An address. A. R. ROSE

Effect of some electrolytes on kaolin and the probable relation to the soil. J. R. SKEEN. *Soil Science* 23, 225-42(1927).—A study was made of the effect of electrolytes upon the turbidity, vol. of sediment, degree of adsorption of electrolytes, and rate of migration of particles of chemically pure kaolin. S. believes that the results apply to clays in general, and advances a theory for the formation of hardpan. R. B.

Mechanism of buffer action in soils. P. B. MYERS AND G. M. GILLIGAN. *Science* 66, 302(1927).—Results obtained with pectin solns. opened the way for a similar attack on soils in which an attempt is now being made to attribute the buffer action exhibited by certain soils to the impurities held by the colloidal fraction. It is hoped that sufficient data may be accumulated to substantiate the claim that buffer action peculiar to soil types laden with colloidal material is not due directly to the colloidal properties of the soil but rather to the salts, metallic or acid radicals that are held by the colloidal fraction. Cf. C. A. 21, 3697. E. F. SNYDER

Effect of mulches on soil temperatures. ALFRED SMITH. *Hilgardia* 2, 385-97(1927).—Mulch papers of a dark color averaged from 5° to 10° F. warmer in the daytime and from 0° to 5° F. warmer at night than unmulched plots. Light colored or perforated mulch papers showed no material effect in increasing the soil temp. beneath them. CARL R. FELLERS

The effect of calcium cyanamide on soil reaction. J. PIEN. *Compt. rend.* 185, 220-2(1927).—In expts. on a series of soils $CaCN_2$ caused a progressive increase in alky. during the 1st 5-10 days, followed by a gradual decrease. The final result was, however, a distinct change in the pH toward alky. The degree and rapidity of these changes were greater in soils rich in colloids (particularly humus) than in poor soils. P. R. D.

The oxidation of sulfur in alkali soil and its effect on the replaceable bases. C. D. SAMUELS. *Hilgardia* 3, 1-26(1927).—A careful review of previous investigations is given. No relation was found between decompn. of carbonates or formation of sulfates taking place during S oxidation in alk. soils. Addn. of H_2SO_4 to soil caused an increase in sol. Na and K with decreased Na_2CO_3 . Approaching complete neutrality of Na_2CO_3 , the concn. of Ca and Mg increased. H^+ was more active in replacement than Ca^{++} , H_2SO_4 proving more efficient in neutralization than $CaSO_4$. The presence of $CaCO_3$ was found desirable in the reclamation of soil with S. In tank and field expts. in which the greater part of the alky. of the soil was neutralized by the addn. of S, there were striking improvements in crop yields. The presence of $CaCO_3$ is very desirable in the reclamation of an alk. soil by means of S. CARL R. FELLERS

Calcium phosphorite from Istum and the plants in soils at various degrees of humidity. M. YEGOROV. *Ukrainskii Khim. Zhurnal* 2, 40-9; *Chem. Zentr.* 1926, II, 487.—A high degree of moisture in the soil increases the activity of phosphorite from the Istum deposits. Phosphorite behaves like $CaHPO_4$. For barley, its action reaches an optimum when the soil contains 80% H_2O . A. L. HENNE

Available phosphoric acid in soil. WRANGELL AND MEYER. *Landw. Jahrb.* 63, 739-75(1926).—Neubauer's seedling method (*Mitt. deut. Landw.-ges.* 47, 596(1923); cf. C. A. 18, 2933) of obtaining the P_2O_5 requirement of soil is compared with Wrangell's colorimetric method (C. A. 21, 2857). The former has many variables compared to

the latter. P_2O_5 concn. varies with the H_2O content. Change in P_2O_5 concn. with H_2O is a result of liberation of absorbed phosphates.

GEORGE R. GREENBANK

Modifications in the solubility of phosphoric acid and the biological properties of soil on leaving fallow after preliminary drying in the open air. A. N. LEBEDYANTZEV. *Compt. rend.* **185**, 397-9(1927); cf. 2 following abstracts.—Expts. in which soil was air dried and then left fallow at approx. 30% moisture and ordinary temp. showed that desiccation has a prolonged effect on the P_2O_5 and the no. of bacteria. The quantity of water-sol. P_2O_5 , markedly increased by drying, was again as low as that in the undried soil after 25 days and did not increase subsequently. However, the P_2O_5 sol. in $AcOH$ and $(COOH)_2$ showed a marked increase in the previously dried soil over quite a long period. The bacterial count, diminished by the preliminary drying, remained lower during 2-3 months; but the intensity of activity, as shown by CO_2 production, was distinctly greater in the desiccated soil.

P. R. DAWSON

Modifications in the solubility of phosphoric acid and the biological properties of soil on leaving fallow after preliminary drying in the open air. A. TH. SCHLOESING. *Compt. rend.* **185**, 399-400(1927); cf. preceding abstr.—Remarks are made on the differences in results obtained by Lebedyantzев and by Schloesing and Leroux (*C. A.* **21**, 2162). Explanation in part is sought in differences in soil types used and in analytical methods.

P. R. DAWSON

Modification of nitrogenous substances in soil dried in the open air and then left fallow. A. LEBEDYANTZEV. *Compt. rend.* **185**, 293-5(1927); cf. *C. A.* **18**, 1726.—Samples of soils, thoroughly dried in the air, were brought to a moisture content of 33%, spread out in 10-cm. layers and kept at 15-20° and approx. const. moisture for 6 months. Comparisons were made with samples of the same soils not previously dried. The soils subjected to preliminary drying were distinguished from those not dried by a more marked accumulation of nitrate, progressing throughout the expt. The ammonia N, which increased abruptly as a result of desiccation, diminished during the 1st 2 months, then increased again and remained at a high level for 4-5 months.

P. R. DAWSON

The reaction to desiccation of different soil types in the tchernozem and podsol zones of European Russia. A. LEBEDYANTZEV. *Compt. rend.* **185**, 568-9(1927); cf. *C. A.* **18**, 1726 and preceding abstr.—Positive reaction to desiccation was observed in all transition types of soils from scarcely degraded tchernozem to highly podsolized clay soils. Of the podsol soils, those in fallow gave a greater reaction, as was the case with tchernozem.

P. R. DAWSON

Use and action of the phosphates on black soil. III. Dynamics of the CaO and iron oxide + alumina (contents) of the soil, and the conditions influencing them. M. YEGOROV and F. MACKOV. *Ukrainskii Khim. Zhurnal* **2**, 7-37; *Chem. Zentr.* **1926**, **11**, 486-7.—A study of the humidity, the porosity, the water-sol. amt., the CaO and sesquioxide content of a black soil at various times in the day and the year, and at various depths. The porosity, *i. e.*, the proportion of air in the total volume ranges between 49 and 55%. The water soluble content increases with the humidity of the upper layer (0 to 2 cm.); it decreases in the deeper layer (15 to 20 cm.). The Al_2O_3 + Fe_2O_3 content decreases when the CaO content increases. The maximum of the soluble Ca content occurs during the hottest hrs. for the upper layer, in the evening time for the deeper layer. An increase in the temp. (17° to 34°) reduces the quantity of water sol. Ca ; an increase of the humidity of the soil increases it.

A. L. HENNE

The reversion of nitrates in the soil under cultural conditions in Mauritius. W. CRAIG and F. GIRAUD. *Bull. Dept. of Agriculture Mauritius; Intern. Sugar J.* **29**, 420-7(1927).—The addn. of large quantities of molasses causes the arrest of nitrification. Nitrates are converted into less available forms when large quantities of org. matter are present. Molasses causes the greatest loss in nitric N, dried green manure and dried farmyard manure following in the order named. Neither of the first 2 substances appears, however, to cause any loss of gaseous N, but with farmyard manure the losses of this kind are quite large.

W. L. OWEN

Ammonification in red prairie soils. H. F. MURPHY. *J. Am. Soc. Agron.* **18**, 177-83(1926).—There was increase in ammonification when CaO or $CaCO_3$ was used on either Vernon or Kirkland soil. Manure as a rule caused no greater increase than did lime, and in some cases it seemed to have a depressing effect. Heavy applications of lime produced more NH_3 than light applications and CaO was more favorable toward ammonification than $CaCO_3$.

F. M. SCHERTZ

Studies of the removal of nutrients from subsoil by alfalfa. C. E. MILLAR. *Soil Science* **23**, 261-70(1927).—Plants enclosed in glass cylinders 2 in. in diam. and 8 in. long in order to exclude roots from the surface soil grew as well as the controls and showed increased growth when nutrient solns. were applied at depths of 36 and 60 inches. Con-

trols did not show the same response to nutrients applied in the subsoil. The ability of alfalfa to absorb from the lower soil horizon is shown (1) by the development of fibrous roots in the region where nutrients were applied, and (2) by the fact that plants enclosed in dry quartz sand to a depth of 15 in. showed no wilting. R. BRADFIELD

Fertility of the soil as related to the forms of its iron and manganese. P. H. BREWER AND R. H. CARR. *Soil Science* 23, 165-73(1927).—Evidence of soil toxicity similar to that described for other soils high in Fe and Mn was noted in a Scottsburg (Ill.) yellow clay. Analysis of the soil showed that the Fe present was mostly ferric, and that most of the Mn was MnO_2 . The fact that the toxicity of such soils is reduced by manures but not by commercial fertilizers is believed to be due to the fact that Fe and Mn are reduced to more sol. forms by the rotting manure. The nature of the color changes observed when manganiferous soils are treated with KSCN soln. is discussed. R. BRADFIELD

A study of the factors influencing the efficiency of different forms of nitrogen as related to soil type and cropping system in the Atlantic coastal plain region. I. A. M. SMITH. *Soil Science* 23, 137-64(1927).—The optimum soil moisture for nitrate production was 50 to 60% of the water-holding capacity for Norfolk sandy loam. Urea and $(NH_4)_2SO_4$ nitrified more rapidly and gave higher nitrate accumulations than fish or tankage. Within the range studied nitrate production from all fertilizers increased directly with rise in temp. At all temps. urea gave the most rapid nitrification, and $(NH_4)_2SO_4$ the highest ultimate accumulations. When both nitrate production and rate of nitrogen accumulation are considered, the materials employed ranked as follows. $NaNO_3$, urea, $(NH_4)_2SO_4$, fish, tankage, activated sludge. An extensive bibliography is appended. R. BRADFIELD

Potassium content of plants as an indicator of available supply in soil. J. W. AMES AND R. W. GERDEL. *Soil Science* 23, 199-224(1927).—Neubauer's seedling method was employed to ascertain whether the K abstracted by plants is a reliable indicator of the K available in the soil. Wheat seedlings produced more plant material in a 20-day period and abstracted more K than either buckwheat or rye and therefore were used as the test plant. They responded to addns. of available K with increased growth and increased K content. The amt. of K abstracted was greater from soils which had been treated with fertilizers and manures. The wheat-seedling method did not, however, indicate as great a deficiency of K as chem. tests and decreased corn yields in the field. R. BRADFIELD

Outgo of calcium, magnesium, nitrate and sulfate from high-calcic and high-magnesian limes incorporated in two soil zones. W. H. MACINTYRE. *Soil Science* 23, 75-97(1927).—Results are reported from 4-yr. lysimeter studies, in which either the surface or the subsurface zone was treated with equiv. quantities of CaO , $Ca(OH)_2$, burnt dolomite, and $CaO-MgO$ mixt. The outgo of Ca was greatest during the first yr. with progressive decrease thereafter for both zones of incorporation. The Mg outgo from surface-zone incorporation of $CaO-MgO$ was greater during the 1st yr. but during succeeding yrs. the same as in the controls; in subsurface-zone incorporations, however, the Mg outgo was greater in all 4 yrs. than in the controls. The total Ca-Mg outgo was similar from all three limes used. The annual outgo was 5 times as great from subsurface incorporations as from surface incorporations. The Ca-Mg ratio in the leachings from $CaO-MgO$ applications varied with the zone of incorporation. Upper-zone leachings carried twice as much Ca as Mg, whereas lower-zone leachings carried twice as much Mg as Ca. The increase in nitrate and sulfate outgo was appreciable during the first year only. It was comparable for all limes, and for both zones of incorporation. R. BRADFIELD

Soil acidity and the growing of sugar beets. W. G. OGG. *Scottish J. Agr.* 10, 224-5(1927).—The reactions of 50 Scottish soils were compared with the yield of sugar beets obtained from them. The majority of cases of crop failure occurred on strongly acid soils and the best yields were obtained on soils having little or no acidity. The subsurface layers in the majority of soils examd. from south-east Scotland were less acid than the surface layers but in a no. of cases the reverse was true. This gave a possible explanation of the check that sometimes occurred in the normal healthy growth of beets that had made a good start. K. D. JACOB

The microflora and the productivity of leached and non-leached alkali soil. J. E. GREAVES. *Soil Science* 23, 271-302(1927).—Untreated soils, natural alkali soils, and soils treated with alkali were leached, and later fertilized or inoculated and cropped. The soils were sampled and analyzed for numbers and kinds of microorganisms before and after all treatments. The addn. of Na salts to soils decreased the bacterial count to a value between untreated and natural alkali soils. Leaching increased the bacteria

of all soils above normal. The greatest increase was in the natural alkali soils, indicating that leaching removed some factor which limited bacterial growth. Nitrification was low after leaching but was increased by both soil ext. and manure. Leaching and treatment with org. manures or inoculating are necessary to restore alkali soils to high productivity.

R. BRADFELD

The digestion of pectin and methylated glucoses by various organisms. H. W. COLES. *Plant Physiology* 1, 379-85(1926).—Only those organisms commonly occurring in the soil are capable of attacking pectin and 3-monomethyl glucose with the production of acid and gas. Pectin and the methylated glucose examd. were not digested with the production of acid or gas by the colon typhoid group of organisms commonly found in feces nor by organisms isolated from the activated sludge of creamery wastes. *Bact. schotmulleri*, *Bact. aertrycke* and other closely related forms cannot be differentiated on the basis of the digestion of pectin and the methylated glucoses examd. W. T.

The existence of daily changes in the bacterial numbers in American soil. H. J. THORNTON AND R. A. FISHER. *Soil Science* 23, 253-9(1927).—A statistical analysis of variations in daily bacterial count at Washington, D. C., indicates that the fluctuations observed are too great to be accounted for by unequal distribution of bacteria in a soil or by seasonal changes, since significant positive correlation between simultaneous samples was obtained with all media used.

R. BRADFELD

Growth of young wheat plants in auto-irrigated soils, as related to the water-supplying power of the soil and to the adjustment of the auto-irrigator. B. E. LIVINGSTON, TAKEWO HEMMI AND J. DEAN WILSON. *Plant Physiology* 1, 387-95(1926).—Description of preliminary greenhouse expts. in 3 different soil media having water-holding capacities of 39.2, 60.7 and 95.1%, resp., to det. the relationship between the growth of young wheat plants in Livingston auto-irrigated pot-cultures and the water-supplying power of the soil about their roots. The water-supplying power of the soil was detd. by the soil point method (cf. *C. A.* 14, 3697), each soil series being in equilibrium with a hydrostatic head of 2, 10, 20, 30 and 40 cm. of Hg, resp. Conclusion: Although growth of the plants was profoundly influenced in some cases by some variable or variables other than the water-supplying power of the soil, this latter factor was, in general, of primary importance in detg. the growth of the plants under the conditions of the expts.

WALTER THOMAS

Relation of the yield and protein content of wheat to the nitrogen content of the soil under ten years of different systems of cropping. R. E. NEIDIG AND R. S. SNYDER. *Idaho Sta. Research Bull.* 5, 3 32(1926).—Under the conditions at Moscow, Idaho, the protein content of wheat is increased by applications of manure. Summer fallowing always increased the available N in the soil and the protein content of the wheat crop following but the latter, although high, was further increased in the crop from plots that were manured. The N/C ratio was higher in the grain from manured than from unmanured plots in all of 8 diff. rotation systems. Manure causes a better utilization of H₂O by the growing crops as shown in higher increases in yield produced during seasons of insufficient rainfall. None of the rotation systems without manure maintained the N and org. matter content of the soil at as high a level as it was at the beginning. Summer fallowing considerably reduces the org. matter and increases the availability of plant foods, especially N in this soil, and causes greater erosion. Crop for crop total foods are more rapidly depleted by fallowing one year in every three than by cropping every year with a suitable rotation. The range of total N and org. C content of the unmanured plots was 0.152-0.170 and 1.41-1.74%, resp. The av. protein content of the wheat from the various expts. ranged from 12.03 to 15.05%.

A. L. MEHRING

The problem of the manufacture of ammonium phosphate as a fertilizer. S. I. POZDNYAKOV. *J. Chem. Ind. (Russia)* 2, 757-8; *Chem. Zentr.* 1926, II, 2839.—Analyses of 2 grades of the American fertilizer "Ammophos" gave in %, resp.: NH₄H₂PO₄ 61.1, 27.9; (NH₄)₂HPO₄ 11.3, 5.8; (NH₄)₂SO₄ 3.7, 57.3; Ca₃PO₄ 2.5, 0.5; (Al, Fe)PO₄ 6.6, 5.5; CaSO₄·2H₂O 3.7, 5.5; CaSiO₃ 0.4, 0.4; insol. residue 5.6, 1.5; water 1.5, 0.4. This compn. shows that this fertilizer can be produced in Russia.

C. C. DAVIS

The production of synthetic nitrogenous fertilizers. H. M. NAGANT. *Sci. Agr.* 7, 401-6; 8, 451-60(1927).—An excellent review of all the important chem. processes of N-fixation with reactions and discussion. Appended are 13 references to the literature.

CARL R. FELLERS

Fertilizer analyses made at Pasoeroean (Java) during the years 1914 to 1926. C. H. VAN HARREVELD-LAKO. *Arch. Suikerind.* 35, 835-50(1927).—Analyses of a variety of fertilizer materials, made according to the Dutch or German official methods, are tabulated and commented upon.

F. W. ZERBAN

The reduction of mineral phosphate by biological methods. K. I. RUDOKOV.

Centr. Bakt. Parasitenk. II Abt. 70, 202-14(1927).—When to a medium consisting of cond. water 1000 cc., mannitol 20 g. and $(\text{NH}_4)_2\text{H}_2\text{PO}_4$ 2 g. a small amt. of soil is added, much of the phosphoric acid is quickly reduced to H_3PO_3 and H_2PO_3 and to phosphine.

JOHN T. MYERS

Can the urea in manure become harmful to plants? OSCAR LOEW. *Centr. Bakt. Parasitenk. II Abt.* 70, 39-41(1927).—If urea-splitting bacteria are absent, the urea in manure may interfere with chlorophyll formation or even cause the death of the plant.

JOHN T. MYERS

Kale fertilizers. H. H. ZIMMERLEY AND M. M. PARKER. Virginia Truck Expt. Sta., *Bull.* 54, 467-76(1926).—The relative values of certain ammoniates when used in top-dressing fertilizers for the kale crop were compared. The N sources compared were NaNO_3 , $(\text{NH}_4)_2\text{SO}_4$, animal tankage, Leunasalpeter and urea. NaNO_3 , $(\text{NH}_4)_2\text{SO}_4$, Leunasalpeter and urea proved equally efficient as sources of N in kale top-dressing fertilizers.

E. F. SNYDER

The inter-relation between silicon and other elements in plant nutrition. W. E. BRENCHELEY, E. J. MASKELL AND K. WARINGTON. *Ann. Appl. Biol.* 14, 45-82(1927).—Sol. silicate has little effect on the growth of barley if P is present, whereas in the absence of P a significant increase in dry wt. of the plant is induced by silicate. The effect is also shown in the increase in height of the main shoot, and increase of leaf development. A close assocn. exists between the amt. of P present and the effect of silicate upon the rate of tillering and no. of tillers produced. Sol. silicates are more active than glass silicates. Variations in response of barley and mustard to silicate on different types of soil were noted. Improvement occurred with increasing doses of silicate accompanied by various combinations of fertilizers especially when P or K was deficient. The results are examined statistically.

C. H. RICHARDSON

Results of experiments on the experimental plot at Ljuberstzk. A. H. VOL'SKII. *Trans. Inst. Fertilizers Lief.* 30, 86-104(1925); *Chem. Zentr.* 1926, I, 2041.—On sandy loam, with an adsorption capacity of 0.06-0.09 CaO acidity of 0.02 CaO per 100 g. of dry soil, the most advantageous quantity of CaCO_3 economically to be added is 7500-9000 kg. per hectare. The addn. of CaCO_3 also increases the favorable action of stable manure. Rye, oats and vetch were used for the expts.

C. C. DAVIS

The cycle of phosphorus in nature. M. YEGOROV. *Ukrainskii Khim. Zhurnal* 2, 71 9, *Chem. Zentr.* 1926, II, 2439.—Stable manure gradually loses P into the air. By drawing air through a mixt. of manure and water, 0.1 of the P in the manure was carried away in 3 days, and the P compds. were recovered from the air by adsorption on activated C. The quantity of P introduced into the air by this method is nearly as much as the quantity of P obtained by pptn. from the air on the earth.

C. C. D.

Liming of pastures. Initial results of experiments in Auckland. T. H. PATTERSON AND J. W. WOODCOCK. *New Zealand J. Agr.* 34, 389-94(1927).—Field expts. carried out in the Pukekohe district, N. Z., over a no. of years indicated that basic slag and ground rock phosphate are better fertilizers for pasture than superphosphate, apparently on account of the high Fe content of the soil.

K. D. JACOB

Some effects of calcium compounds on the soil and on plant growth. W. T. H. WILLIAMSON. *Scottish J. Agr.* 10, 180-4(1927).—The effect of CaCO_3 , CaCl_2 , mineral phosphate and superphosphate on the acidity and exchangeable Ca content of a soil deficient in the latter was studied in plot expts. Mineral phosphate reduced the acidity and increased the exchangeable Ca content but not to as great an extent as CaCO_3 . Heavy applications of superphosphate, 8.75 to 12.5 tons per acre, gave an immediate increase in soil acidity which persisted for about 6 months. The soil was finally no more acid than the untreated soil and the exchangeable Ca content was greatly increased. With CaCl_2 at the rate of 12.5 tons per acre the acidity of the soil was immediately increased to a considerable extent and then slowly decreased until after 1 year it was no more acid than the untreated soil. The exchangeable Ca content was considerably increased. The immediate effect of such heavy applications of CaCl_2 was to destroy practically all forms of vegetation but after 1 year the plots produced crops of barley which, in some cases, were as good as those obtained from plots receiving heavy applications of CaCO_3 . The investigations are being continued.

K. D. JACOB

The influence of calcium carbonate on the soil. A. A. RODE. *Izvestia Leningrad. Lesnogo Instituta* 34, 119-80(1927).—R. deals with the problem of the influence of Ca additions on the decompn. of org. matter. Podsol soils which contained high quantities of C (12.86%) and highly unsatd. (0.02842 g. of H ions per 100 g. of soil as detd. by the BaCl_2 method) were used. Chernozem soils (1.97% C) were treated with 0.05 N HCl to make it unsatd. and then treated with CaCO_3 . In the podsol soils the unsatd. equalled 0.6252 g. CO_2 per 100 g. of soil; in reality 1.43 g. of CO_2 was liberated

from the soil upon the addn. of CaCO_3 . This is due to the decompn. of org. matter. As the quantities of CaCO_3 were increased the liberation of CO_2 decreased after a certain period of incubation. The explanation is that in the beginning the Ca neutralizes the excess of acid (unsatn.); this disturbs the equilibria (chemical and biological) and the org. substances not capable of decompn. at the acid reaction begin to be decomposed upon the addition of CaCO_3 ; a new equil. is reached whereby the Ca ions decrease the dispersion, and decompn. ceases. This was corroborated with the chernozem soil; in the artificially unsatd. chernozem the process was similar to the podsol soil; in the normal chernozem the addn. of lime had no influence on the decompn. of org. matter. Excess of CaCO_3 increased the capacity for base exchange. The author refers to the work of Tyulin and Askaniy.

J. S. JOFFE

The influence of boron on the growth of the soy-bean plant. J. H. COLLINGS. *Soil Science* 23, 83 105(1927).—An intensive investigation was made of the effect of B in the form of H_3BO_3 and K and Na borates upon the germination and growth of soy beans in sand, soil and soln. cultures. Germination was retarded by 10 mg. B per l. and prevented by 250 mg. per l. Applications of 1 lb. B per acre produced visible toxicity in sand and soil cultures. In nutrient solns. 0.1–0.2 mg. B per l. caused brown spots on the leaves. In all the expts the effects of the diff. carriers of B seemed to be identical. In no case was any marked stimulation observed during the seedling stage, although some was noted when the plants were grown to maturity in soln. cultures contg. 2.5 mg. B per l. Normal mature soy bean plants were obtained, however, without the application of B.

R. BRADFELD

The effect of fertilizing conditions on the nutritive and vitamin values of millet and wheat. R. MCCARRISON AND B. VISWANATH. *Indian J. Med. Research* 14, 351–78 (1926).—Soil fertilized with farm yard manure yielded millet or wheat of higher nutritive value than the same soil fertilized with a complete mineral fertilizer or soil not fertilized for years. This difference seems to be in the vitamin content of the grain.

FRANCES KRASNOW

Experiments, of the nature of a survey, on the stimulant action of certain salts on the growth of grains. HUGO KAHN. *Acta Comment. Univ. Dorpatensis* 8, A VIII, 7, 17 pp.(1925); *Chem. Zentr.* 1926, II, 237.—It is attempted through systematic expts. to do away with the confused ideas about growth stimulation which have up to the present prevailed. Wheat grains were treated with a large no. of neutral salts, chiefly K salts, which are known to promote swelling. Salts of heavy metals and salts of the alk. earths were also tested. Pure water served as control, and in most cases had by far the most favorable effect. Next to water came the K salts, with which the nature of the anion did not play a decisive part in the action. The alk. earth salts and salts of heavy metals showed, with the exception of Mn salts, practically no stimulating influence on growth. When mixts. of K salts and other salts were used, there was almost always a retarding effect on the swelling.

C. C. DAVIS

Stinking-smut of wheat. V. Summary of three years' experiments on control and detailed results for 1926–27 season. J. C. NEILL. *New Zealand J. Agr.* 35, 28–34(1927); cf. *C. A.* 20, 3329.—Cu carbonate dust gave satisfactory control but produced 4% fewer heads of wheat than from the same wt. of untreated seed. Clarke's Wheat Protector, CuSO_4 1% soln., and formalin 1 part to 480 parts of soln., gave good control but caused decreases in yield of 17, 20 and 18%, resp. CuSO_4 2% soln. and formalin 1 to 320 soln. decreased the yields of wheat 24 and 27%, resp. The mercurio-phenol preps., Semesan, Uspulun and Germisan, gave good but not complete control of smut and in general caused a slight increase in the yield of wheat. All of the treatments were successful in 1 or 2 of the seasons but none gave complete control in all 3 seasons. In expts. during one season "colloidal Cu" gave results similar to Cu carbonate.

K. D. JACOB

Hot-water treatment of seed barley. C. H. HEWLETT. *New Zealand J. Agr.* 34, 409–12(1927).—Barley smut was completely controlled by pre-soaking the seed 5–6 hrs. at 78° F. followed by dipping for 5 min. at 127° F. The treatment delayed germination of the seed but the final percentage germination compared favorably with that of the untreated seed.

K. D. JACOB

Recent investigations on contact insecticides. F. TATTERSFIELD AND C. T. GIMINGHAM. *J. Soc. Chem. Ind.* 46, 368 72T(1927).—See *C. A.* 20, 2558; 3769 and following abstr.

E. F. SNYDER

Studies on contact insecticides. V. The toxicity of the amines and N-heterocyclic compounds to Aphis rumicis L. F. TATTERSFIELD AND C. T. GIMINGHAM. *Ann. Appl. Biol.* 14, 217–39(1927); cf. *C. A.* 20, 3769.—Quant. expts. show that $(\text{CH}_3)_2\text{N.OH}$

and $(\text{CH}_3)_4\text{N}.\text{Cl}$ are more toxic to this aphid than the corresponding $(\text{C}_6\text{H}_5)_4\text{N}$ compds. Aromatic amines show little toxic action but the substitution of aromatic groups in the NH_2 group of $\text{C}_6\text{H}_5\text{NH}_2$ results in a greater increase in toxicity than the substitution of aliphatic groups. The following orders of toxicity were observed in the aromatic amines: $\text{C}_6\text{H}_5\text{NH}_2 < (\text{C}_6\text{H}_5)_2\text{NH} > (\text{C}_6\text{H}_5)_3\text{N}$; $\text{C}_6\text{H}_5\text{NH}_2 < \text{C}_6\text{H}_5\text{NHC}_6\text{H}_5 > (\text{C}_6\text{H}_5\text{CH}_2)_2\text{N} < \text{C}_6\text{H}_5\text{CH}_2\text{NH}_2 < (\text{C}_6\text{H}_5\text{CH}_2)_3\text{N}$. *o*-Nitroaniline is one of the most toxic of the $\text{C}_6\text{H}_5\text{NH}_2$ derivs. $\alpha\text{-C}_{10}\text{H}_7\text{NH}_2$ is more toxic than $\text{C}_6\text{H}_5\text{NH}_2$ but substitution of various radicals into the NH_2 group of the latter compd. has a greater effect on toxicity of the resulting compd. than the same substitution into $\alpha\text{-C}_{10}\text{H}_7\text{NH}_2$. The order of toxicity of the simpler N-heterocyclic compds. is: pyrrole < pyridine < picoline < lutidine < quinoline and isoquinoline < acridine. Hydrogenation of pyridine and pyrrole increases their toxicity, piperidine being more toxic than pyridine and pyrrolidine more toxic than pyrrole. Benzylpyridine was the most toxic pyridine deriv. investigated. The toxicity of nicotine is discussed. VI. The insecticidal action of the fatty acids, their methyl esters and sodium and ammonium salts. *Ibid* 231-58.

The fatty acids from HCOOH to stearic acid, their Na and NH_4 salts and their Me esters have been examd. with respect to their toxicities to an aphid (*Aphis rumicis*). The unsatd. acids, undecenoic and oleic, were also included. Toxicity increases with increase of mol. wt. from CH_3COOH to undecylic acid, HCOOH being exceptional. Beyond undecylic acid a fall in toxicity occurs, acids in the series higher than tridecylic showing only slight toxic action. The Na salts are generally less toxic than the corresponding acids, the difference being less marked with the higher acids. Oleic acid and Na oleate are of equal toxicity. The NH_4 salts are generally less toxic than the corresponding acid but the differences are much less marked than with the Na salts. NH_4 metastate, NH_4 oleate and some others are more toxic than the corresponding acids. The increased toxicity probably results from the fact that upon hydrolysis the free acid is liberated in a very finely divided state. Methylation of the fatty acids reduces their toxicity, all the Me esters being less toxic than the acids or NH_4 salts. The NH_4 salts and Me esters show increased toxicity with increase of mol. wt., the formates being exceptional. Fatty acids at concns. below 2% are not markedly toxic to the eggs of *Selenia tetralunaria*. Possible relationships between toxic action and the phys. state of the compds., volatility, dissoen. consts., partition coeffs. and surface tension are discussed. A steady rise in toxicity with decrease in partition coeffs. (water/oil) from CH_3COOH to caproic acid was noticed and is discussed. HCOOH again was exceptional. Methods are described. Cf. preceding abstr. C. H. RICHARDSON

Simple and rapid methods for determining the active ingredients of fungicides and insecticides. III. Titrimetric determination of polysulfide sulfur. J. BOBŇAR and WILHELMINE GERVAY. *Z. anal. Chem.* 71, 446-58(1927); cf. *C. A.* 21, 622.—A description of the various methods for the analysis of polysulfides is given and the results of comparative tests made with 4 volumetric methods and 1 gravimetric method are shown. On the whole, E. Schulek's method proved the most satisfactory volumetric method. It depends upon the formation of alkali thiocyanate by treatment with alkali cyanide in the presence of boric acid and iodometric titration of the thiocyanate. W. T. H.

The residual insecticidal action of lubricating oil sprays on the pear psylla. W. A. ROSS. *Sci. Agr.* 7, 395(1927).—Oil sprays, in addn. to destroying large nos. of adults, have a very important residual insecticidal action, to a very marked extent then prevent egg laying. It is this residual action, which no doubt explains why lubricating oil sprays have given much cleaner-cut results in psylla control than other contact insecticides such as nicotine sulfate. CARL R. FELLERS

The influence of ammonium sulfate as a direct source of nitrogen for apple trees. M. B. DAVIS. *Sci. Agr.* 8, 41-55(1927).—N in the form of $(\text{NH}_4)_2\text{SO}_4$ is not available for apple trees. As soon as nitrifying organisms are present in the substratum the $(\text{NH}_4)_2\text{SO}_4$ series appeared to give about as good growth response as did NaNO_3 . When applied in quantities which appear to be above the optimum concn., toxicity decreased in the order named: cyanamide, $(\text{NH}_4)_2\text{SO}_4$, NaNO_3 , indicating that under conditions where nitrifying bacteria are not present, NaNO_3 is less dangerous than either of the other 2 N compds. It appears that $(\text{NH}_4)_2\text{SO}_4$ becomes available on a very poor sand when nitrifying organisms are present. CARL R. FELLERS

A preliminary study of petroleum oil as an insecticide for citrus trees. E. R. DE ONG, HUGH KNIGHT AND J. C. CHAMBERLAIN. *Hilgardia* 2, 351-84(1927).—Petroleum oils in relation to their availability as insecticides for use on citrus trees were investigated. Non-viscous oils of low b. p. such as the kerosenes are safer to use on the tree than those of higher b. p., but are unsatisfactory as scalecides because of rela-

tively low toxicity combined with high volatility. Highly refined white lubricating oils are most advisable for use in summer on citrus trees. Low-viscosity oils are safer to use on trees than high-viscosity oils because of the more rapid disappearance of the former. Severe injury to the trees is assocd. with a high % of unsatd. hydrocarbons. Filtration of oil through fuller's earth is ineffective. A quick-breaking emulsion utilizes to the max. degree the insecticidal agent. Non-volatile lubricating oil, 2%, with 98% H₂O as a carrier was 100% effective in lab. tests on red scale. Stable oil emulsions using the same ingredients are ineffective against this scale in strengths of 4-8% actual oil. The quick-breaking action in an emulsion is greatest when the av. size of the dispersed oil globules is greatest, and that size is greatest when the proportion of emulsifier to oil is least. The insecticidal action of unrefined lubricating oils seems to consist of suffocation and toxic action. The former results from non-volatility (film permanence), the latter chiefly from the action of unsatd. hydrocarbons with unrefined petroleum oils or that of free fatty acids with vegetable oils. The lethal immersion period varied from a few sec. for the most toxic substance to 16 days for the least toxic. Volatility limits of oil range from a few min. or hrs. to several weeks. Cross symptoms of injury to citrus trees from the use of unrefined petroleum oils include defoliation, fruit spotting and dropping and the killing of twigs and branches. There is also apparent interference with the normal-plant functions of transpiration and respiration. Refining petroleum oil with H₂SO₄ removes the following injurious constituents: aromatics, olefins, resins and S.

CARL R. FELLERS

Chemicals in puncture vine control. ETHELBERT JOHNSON. *Monthly Bull. Calif. Dept. Agr.* 16, 354-5 (1927).—AsCl₃ destroys the underground stems of some species of creeping perennials. It is effective even in very dil. solns. in destroying the top growth of many annual weeds including puncture vine, if applied before the seeds mature. Vegetation sprayed with AsCl₃ is repulsive to grazing animals and they avoid it. Arsenite-sprayed vegetation, on the other hand, is very attractive to grazing animals and is so toxic that a few mouthfuls may cause death.

CARL R. FELLERS

The internal therapy of plants. ADOLF MÜLLER. *Z. angew. Entomologie* 12, No. 8, 1-206; *Chem. Zentr.* 1926, II, 2446. —The literature is discussed in great detail. To remove leaf lice, the cut sprigs were immersed in dil. alc. solns. and in solns. of chloral hydrate. The lice were killed by 5% alc. solns. without injury to the leaves, whereas a similar chloral hydrate soln. killed both lice and leaves. Expts. in the internal therapy of a no. of plants were carried out. The substances to be tested were injected, or the cut sprigs immersed in the solns. The solns., which were tested at various concns., included quinine chloride, quinine sulfate, EtOH, chloral hydrate, CuSO₄, colloidal Cu in the presence of NH₄OH, colloidal Ag in the presence of NH₄OH, colloidal Hg in the presence of NH₄OH, As₂O₃, *Segetan I* and a series of mixts. of various compds. whose ions were Cu and Hg in combination with various inorg. and org. anions. To combat the blood louse, alum, chloral hydrate, nicotine chloride and pyridine were used, and to det. what is tolerated by the individual plants, the latter were treated with solns. of H₂SO₄, HCl, HNO₃, NaOH, Al₂(SO₄)₃, MgSO₄, BaCl₂, KCl, NaCl, CuSO₄, Cu(OAc)₂, Zn(OAc)₂, HgCl₂, EtOH, HCO₂H, chloral hydrate, AcOH, PhOH and pyridine. The manner in which these compds. act upon the various parts of the plants is described in detail and compared with work of previous investigators.

C. C. DAVIS

Earwig control. H. C. LEWIS. *Monthly Bull., Calif. Dept. Agr.* 16, 469-71 (1927).—Poison bran baits said effectively to control the pests consist of NaF 1 lb., molasses 2 qts., H₂O 2 gal., wheat bran 16 lbs. Another improved bait is composed of wheat bran 5, sugar 2 1/2, meat meal 2 1/2 lb., and Paris green 10 oz.

C. R. F.

The control of glasshouse insects with calcium cyanide. H. W. MILES. *Ann. Appl. Biol.* 14, 240-6 (1927).—Expts. show that this compd. can be used to control greenhouse pests in Great Britain.

C. H. R.

Fertilizing in relation to the control of shot-hole borer of tea. F. P. JEPSON AND C. H. GODD. *Dept. Agr. Ceylon, Bull.* 78, 1-49 (1926).—Fertilizer treatments using N, K, P₂O₅ and lime had no direct effect upon beetles. A benefit was derived from the use of manures, however, for they served to accelerate the healing of galleries. Healing was most marked in plots treated with nitrogenous manures. Healing was complete in 2.9 months on N plots and not until 3.75 months in the control plot.

M. S. A.

Cauliflower production in California (JONES, ERNST) 11D. The fixation of atmospheric N as cyanide [use for combating plant vermin] (WÄSSER) 18. Preparation and mechanical treatment of phosphates (VERKHOVSKII) 18. Selective absorption of ions in colloidal clay (DEMOLON, BARBIER) 2.

Phosphatic fertilizers. B. BODREKO. Brit. 262,878, Sept. 22, 1925. Natural Ca phosphates are washed to remove carbonate, mixed with S, and maintained at 40–50° in app. such as silos or ovens in which they are treated with jets of steam. Other materials such as fresh bones, ground meat and dried and ground blood may be added.

Phosphatic fertilizers. L. ADELANTADO. Brit. 262,833, June 9, 1925. Natural phosphates contg. substantial quantities of Fe or Al, or mixts. of such phosphates with Ca phosphate (which may be rich in CaCO_3) are treated with a sulfate of an alkali metal or of NH_4 or Mg and with an acid such as H_2SO_4 or an acid salt to produce a neutral or very slightly acid product without heating. Various other fertilizing materials may be added such as peat, sewage sludge and org. factory or tannery wastes. Cf. C. A. 20, 2223.

Fungicide. K. BRODERSEN and W. FEXT. Can. 274,042. Sept. 20, 1927. A dry fungicide contains a halogenated addition product of a quinone with a phenol.

16—THE FERMENTATION INDUSTRIES

C. N. FREY

Influence of water containing sulfuric acid on the germinating power of steeped grain. J. DEHNICKE. *Z. Spiritusind.* 49, 336–7(1927).—After steeping and aeration grains were added to acidified H_2O . Varying amts. of H_2SO_4 were added to the batches. In a concn. of 0.049 g. H_2SO_4 per 100 cc. germination was normal. Above this amt. germination was diminished. Mold growth on grain is influenced by time of exposure and concn. of acid.

C. N. FREY

The function of diastase and its determination in the mash. F. WENDEL. *Z. Spiritusind.* 50, 9(1927).—The following method was developed by Ellrodt. Add 15 cc of 1% sol. starch to a stoppered vessel graduated to 15–20 cc. Add 5 cc. of the filtered mash, shake and suspend the flask for 1 hr. in a bath at 28°. Add 1 soln. and note color change. A yellow color indicates a large amt. of diastase, a red color a small amt. and a blue-violet disappearance of diastase.

C. N. FREY

Nitrogen for yeast in fermenting corn and potato mashes. J. DEHNICKE and W. KILP. *Z. Spiritusind.* 50, 202–4(1927).—These expts. indicated that org. N, such as asparagine or malt exts. should be added to corn mashes. During the initial mashing period temps. of 48–52° should be maintained, but during later stages the temp. should be allowed to rise to 60°.

C. N. FREY

The utilization of fusel oils. E. LÜDDE, B. LAMPE and W. KILP. *Z. Spiritusind.* 50, 245–6, 255(1927).—By the use of modern distg. app. alc. of high degree of purity is produced. The slop contains a large amt. of fusel oil and consequently it is unfit for feeding purposes. By means of a fractionating column fractions were withdrawn at various temp. levels and analyzed. It was found that the official method did not give reliable results for detg. Am alc. or the other high-boiling fractions.

C. N. F.

The detection of fruit wine in grape wine. TH. RÖRTGEN. *Chem.-Ztg.* 51, 697–8(1927); cf. C. A. 21, 796.—The detn. of adulteration by means of ultra-violet light is not practical on account of the difficulty of obtaining a proper standard for comparison. When testing for adulterants by means of his reagent, their presence is not evident with some wines. In cases of this sort the proportion of reagent to wine is changed from 1:17 to 2:18, and the correct green color is then obtained. A new method consists of neutralizing wine with concd. NaOH and transferring to 25-cc. graduate. To 10 cc. of adulterated wine add 10 cc. of cold, satd. baryta soln., shake, and let stand. The ppt. is colored gray with a tinge of yellow with adulterated wine, and gray with a mixt. of red in the case of pure grape wine.

C. N. FREY

Estimation of methanol in alcohol and alcoholic beverages using the immersion refractometer. J. F. WILLIAMS. *Ind. Eng. Chem.* 19, 844–5(1927).—The method is based upon the refractive indices of the alcs. and the apparent total percentage of alc. as ethyl from the sp. gr., when a 20% soln. is used. When less than 1% methanol is present a set of colorimetric standards should be made. Acetone in traces does not affect the accuracy of the method.

C. N. FREY

The physiology of *Bacillus acidificans longissimus* (B. delbrücki) in connection with the possibility of utilizing it for the industrial production of lactic acid. V. SHAPOSHNIKOV and A. Y. MANTEIFEL. *Trans. Sci. Chem. Pharm. Inst.* 1923, No. 7, 3–23.—To obtain the max. amt. of lactic acid compds. in the medium it is necessary to add a neutralizing agent on the second day of inoculation. Fermentation proceeds until no sugars remain in the medium. The lactates found do not hinder the process and

by a continuous neutralization the vessel may be filled with the solid lactates. MgO , MgCO_3 or ZnO may be used. J. S. JOFFE

Color changes of beer during the primary fermentation. W. WANDERSCHNECK. *Wochschr. Brau.* **43**, 391-5, 403-8(1926).—The color of a wort becomes appreciably lighter during fermentation, but with bottom fermentation of the Pilsen types it becomes darker. This is said to be due to adsorption of color by yeast which later is redissolved. Air inhibits the action, but CO_2 accelerates it. Bottom yeast is more subject to this action than top yeast due to greater duration. Na_2CO_3 aids in improving the color. B. C. A.

Buffer substances in wort and beer. P. KOLBACH. *Wochschr. Brau.* **43**, 123-9, 135-40(1926); cf. *C. A.* **21**, 2355.— CO_2 plays a part in lowering p_{H} , in some instances from 5.87 to 5.15, and should not be removed when the test is made. Primary and secondary phosphate mixt. is most effective as a buffer at p_{H} 6 to 7.6. Primary and secondary phosphates counteract alky. The total buffer action is probably due to the above substances and to proteins, polypeptides and amino acids, but no definite statement can be made. C. N. FREY

Influence of hop constituents on head formation in beer. W. WINDISCH, P. KOLBACH AND W. BANHOLZER. *Wochschr. Brau.* **43**, 207 9, 217 23, 229-35, 241 6, 253-8 (1926).—Hop derivs. contribute more than any other constituent of beer to head formation. Length of boiling up to 3 hrs. has very little effect. Ether exts. all of the foam-forming constituents from hops, humulone being the most important element. Humulinic acid is a product of hydrolysis. The acid is more effective than its precursor. C. N. FREY

Influence of the brewing water on the acidity of the wort and beer. W. WINDISCH AND P. KOLBACH. *Wochschr. Brau.* **43**, 423 8, 444 7(1926).—With the addn. of CaSO_4 the H -ion concn is increased and the amt. of buffer diminishes. $\text{Ca}_3(\text{PO}_4)_2$ is pptd. The titratable acidity is not greatly changed. When MgCO_3 or Na_2CO_3 is added, the p_{H} is increased as well as the buffer material and titratable acidity. CaCO_3 decreases the H -ion concn., but not as greatly as Na_2CO_3 . Usually the amt. of buffer in the beer is less than in the original wort. B. C. A.

Measurement of foam in beer and the factors which influence it. K. GEYS. *Wochschr. Brau.* **43**, 439 44(1926).—The p_{H} and humulone are the factors governing foam in beer. The amt. of yeast used affects the p_{H} . Low p_{H} tends to coagulate the proteins. When the protein is peptized, little foam is formed and proper head retention is not obtained. B. C. A.

Resinification of the α -bitter acid of hops (humulone) by molecular oxygen. W. WINDISCH, P. KOLBACH AND J. YOFÉ. *Wochschr. Brau.* **43**, 349 53, 359-63, 369-72, 379-83(1926).—During boiling of hopped wort humulone is oxidized to resinous substances. During storage oxidation takes place, especially if O_2 and H_2O are present. When oxidized to 30-40% it becomes stable and further oxidation is difficult. In a dry state humulone is stable. Heating fresh hops drives off the volatile matters, such as hop oil, which accelerates oxidation of humulone and therefore aids in preservation. B. C. A.

The fermentation of the lambics. M. H. VAN LAER. *Bull. fed. ind. chim. Belg.* **6**, 357-65(1927).—The "lambic" is a kind of beer made exclusively in Brussels. Its fermentation is due to 3 kinds of ferments, i. e., *Saccharomyces* species, *Saccharomyces bruxellensis*, *Brettanomyces bruxellensis* and *Brettanomyces lambicus*, the 2 latter being of the same kind. The fermentation curves have been detd. in each case. The bouquet of the beer is due to *Bacillus bruxellensis*. *Bacillus viscosus bruxellensis*, often found in the "lambic," is in no way responsible for its fermentation; it transforms the sugars into lactic, acetic and butyric acids; it also attacks the substances contg. N. A. L. HENNE

Glassy malt. W. WINDISCH. *Wochschr. Brau.* **44**, 372(1927).—Glassy malt is due not to over moistening of the grain and drying at high temp. as formerly believed, but is caused by the lack of cyase action on a resistant cellulose. C. N. FREY

Constitution and determination of pectins and gums in wines and in grape musts. L. SEMICHON AND M. FLANZY. *Ann. fals.* **20**, 395-9(1927); cf. *C. A.* **20**, 3534; **21**, 1165.—The previously unidentified org. portion of the pectic nucleus has been found by qual. and quant. detns. to consist of glycerol and to be free from fatty acids or org. bases. Results obtained to date indicate that the pectin mol. consists of a pectic acid nucleus, esterified on the one hand by 1 or more OMe groups, on the other hand by glycerol, which itself is esterified as a glycerophosphate of Ca, Mg and a little Al. The ratio of Ca glycerophosphate to Ca pectate was found const. in freshly prepd. pectins; but pectins dried at 90° and kept for a few weeks or months show progressive trans-

formation. Previous detns. of MeOH in pectic acid, calcd. from the sapon. value, are considered inaccurate because of the simultaneous sapon. of the methylpectic, glyceropectic and glycerophosphoric esters. Gums and pectin are detd. as follows: to 100 cc. of must or wine add 1 cc. HCl and enough neutral 96–7% alc. to give a final concn. of 80% by vol., let stand till the supernatant liquid is quite clear (generally 24 hrs.), filter through a double tared filter, wash to neutrality with 80% alc., dry at 90° and weigh the gums and pectin; redissolve the ppt. in cold freshly boiled distd. water, add 20 cc. of CO₂-free 0.1 N KOH, boil 1 hr. under a reflux condenser, cool, acidify with AcOH to keep the P₂O₅ in soln., let stand 15 min., ppt. with 10% CaCl₂ soln., boil 15 min. under a reflux condenser to flocculate the ppt. without loss of AcOH, filter, wash and dry as above, and weigh as Ca pectate; ppt. the gums in the filtrate by means of 96 7% alc., and proceed as previously described for the pectin ppt. The Ca pectate ppts. obtained contained 6.39–6.53% Ca, av. 6.46%; whence the mol. wt. of pectic acid must be of the order of 581.

The detection of fruit wine in grape wine. M. RÜDIGER and W. DIEMAIR. *Chem.-Ztg.* 62, 597–9(1927).—The phosphomolybdic acid and NH₃ reagent, the aurosodium chloride and the reaction of Röttgen are discussed. It is concluded that there is at present no satisfactory method known for detg. adulteration of grape wine by fruit wine.
A. PAPINEAU-COUTURE
C. N. FREY

Sulfur dioxide in wine making: determining the amount to be added by the combination numbers of the sulfur dioxide with the wine constituents. L. MOREAU and E. VINET. *Ann. fals.* 20, 316–25(1927).—Addn. of SO₂ to must or wine up to a certain limiting value, designated as the total combination no., *T* (expressed in mg. per l.), results in its complete combination with aldehydes, etc. If a greater amt of SO₂ is added, the amt. remaining free after equil. has been reached is a practically const. fraction of the excess over *T*. It is designated as the residual SO₂ no., *R*, and is expressed as mg. free SO₂ per l., per 100 mg. SO₂ added per l. in excess of *T*. For all practical purposes, equil. in the combination of SO₂ with wine or must may be considered to be reached after 4 days. *T* and *R* may, therefore, be found by adding 2 different proportions of SO₂ (both greater than *T*) to a known vol. of must or wine and detg. free SO₂ after 4 days. When results are required in a short time, the free SO₂ in the 2 solns. may be detd. after 2 and again after 4 hrs., and the 2 straight-line curves plotted: if the 2 lines intersect the SO₂-axis at the same or neighboring points, this gives the value of *T*; if the 2 lines are substantially parallel *T* can be detd. only at the end of 4 days, but may be taken as approx. 1.25 times the value after 4 hrs. The values of *R* for musts and wines of a given region are fairly const., and a mean value may be taken. Values of *T* found for musts of a given region (Maine-et-Loire) were 50–170, and for wines 30–205; the values of *R* for musts were 42–56, and for wines were practically const. at 75. The amt. of SO₂ which should be added to obtain a given free SO₂ content in a given must or wine can be calcd. from its *T* and *R*.
A. PAPINEAU-COUTURE

Dry yeast fermentation. TH. SABALITSCHKA and R. WEIDLICK. *Apoth. Ztg.* 42, 1011–6(1927).—A study has been made of the fermentative action of medicinal yeast, based on the behavior of some 15 different kinds of yeast, notably with respect to the influence of concn. of sugar soln., relation of its vol. to amt. of yeast, and rapidity of fermentation as affected by NaHCO₃ in varying concn.
W. O. E.

Alcoholic fermentation of glucose solutions with water exposed to the radiations of a mercury vapor lamp. REMO DE FAZI. *Atti accad. Lincei* [6], 5, 901–5(1927); cf. *C. A.* 21, 2045.—Glucose solns. prepd. from distd. water previously exposed to ultra-violet light fermented more rapidly (when used immediately) than similar solns. prepd. from water not first irradiated. The rate of fermentation was, however, in no case so great as that of glucose solns. irradiated after their prepn. The addn. of irradiated water to pure yeast had a favorable action on the alc. fermentation. On the other hand the fermenting power of impure or enfeebled yeast was diminished by treatment with irradiated water, for when 2 identical glucose solns. were fermented with impure enfeebled yeast and to the 1st was added distd. water and to the 2nd was added an equal vol. of irradiated water, the rate of fermentation of the latter soln. diminished immediately. It is certain, therefore, that when exposed to ultra-violet light in the absence of air sterile distd. water acquires a new property which persists for a certain and still undetd. time.
C. C. DAVIS

Colorimeters based on Ostwald's theory. F. MESTAN. *Wochschr. Brau.* 43, 312–6(1926); cf. *C. A.* 21, 623.—Adler's app. for measuring color of malt exts. is more suitable than Ostwald's chrometer.
B. C. A.

The occurrence of sulfur dioxide in malt vinegar. H. E. COX. *Analyst* 52, 397–8(1927).—Many samples of malt vinegar have been examd. and none was found

absolutely free from SO_2 . From 10 to over 30 parts per million of SO_2 may be found although no preservative has been added intentionally. W. T. H.

Is the production of water-free motor fuel a luxury or a necessity? FRITZWEILER. *Z. Spiritusind.* 50, 260-70 (1927).—Abs. alc. is a necessity if its proper development as a motor fuel and its further utilization in the industries is to take place. C. N. F.

17—PHARMACEUTICAL CHEMISTRY

W. O. EMERY

Culture of the cinchona tree in Indo-China. AUG. CHEVALIER. *Rev. botan. appl. agr. colon.* 7, 132-4 (1927).—Analyses are given of the bark from cinchona trees grown with different fertilizer treatments. The cinchonidine content varied from 0.68 to 1.18%, the highest value being obtained from trees grown in soil treated only with lime. The quinine content varied from 4.47 to 7.0%, the quinine sulfate content from 6.01 to 11.48%, and the total alkaloids from 8.2 to 10.9%. In the case of each of these the highest values were from soil treated with animal manure. M. S. A.

Commercial notices and scientific data on ethereal oils. SCHIMMEL & Co. *Ber. von Schimmel & Co.* 1926, 3-133, *Chem. Zentr.* 1926, 11, 658-9.—Among comprehensive reviews of the literature and com. notices appear the following data covering research of the labs. of Schimmel & Co. *Valerian oil* obtained from dried Thuringian valerian roots in 0.49% yield, was yellow-green, had d_{15}^{20} 0.9623, n_D^{20} 1.48599, acid no. 5.6, ester no. 128.8, was miscible with 90% EtOH in all proportions but was not wholly dissolved by 10 vols. of 80% EtOH. *Light camphor oil* is recommended as a substitute for oil of turpentine, e. g., *Type CLA*, which is very mild, has d 0.86, b 167-195°, flash point 41°; *Type CLS*, with stimulating odor, d 0.88, b 176-210°, flash point 44°; *Type FL*, with odor of conifers, d 0.89, b 180-210°, flash point 46°. *Citronella oil*.—Two samples of Ceylon oil were of inferior quality, because of their low geraniol content (26.4 and 28.2%, resp.). One was probably a by-product of the production of geraniol, and the other by its dextro-rotation showed adulteration, probably by a fraction of camphor oil. A sample from Holland, which was of high quality based on its ester no., had much too high d . (0.9559) and contained considerable BzOH , probably as BzOCH_2Ph . *Coriander oil*.—Besides adulteration with anise oil and anethole, already reported, a sample was found with terpineol. It had too high d ., too low rotation and too high acetylation no. *Elemi oil*.—A sample of elemi resin from Bandjaranegara (Java), which was distinguished from ordinary grades by its dirty-gray color changing to brownish and by its low oil content (16.7%), gave a colorless oil, d_{15}^{20} 0.8517, $[\alpha]_D^{20}$ 104°35' (after 4 mos. 68°10'), n_D^{20} 1.47779, and dissolved in 4.5 vols. of 90% EtOH with strong phellandrene reaction. *Bergamot oil*.—The consts. of 4 oils adulterated in different ways are compared with those of pure oil. The addn. of lemon oil terpenes to 2 of the oils was concluded, while the 3rd oil had been adulterated with an ester of lauric acid and a little glycerol acetate to compensate for its low ester no. resulting from the other adulterant. The 4th oil had a high terpinol acetate content. *Lemon oil*.—In one case adulteration with oil of turpentine was detected, and in another case with terpenes and a phthalic ester. Still another sample contained a large proportion of terpineol. *Eucalyptus oil*.—Oils from the *Eucalyptus dives* from Australia had a higher d . and in some cases lower rotatory power than reported by Gildemeister and Hoffmann. Oils from reliable sources had d_{15}^{20} 0.8969-0.9188, $[\alpha]_D^{20}$ -46°55' to -61°48', n_D^{20} 1.48209-1.48577 and dissolved in 0.5-1.3 vols. of 80% EtOH and were miscible in all proportions with 90% EtOH, contained 43-50% piperitone and a high phellandrene content. An oil of *Eucalyptus macarthurii* Deane et Maiden had d_{15}^{20} 0.9307, $[\alpha]_D^{20}$ 4°40', n_D^{20} 1.47534, acid no. 2.6, ester no. 166.1, ester no. after acetylation 212.8 (69.6% total geraniol) and dissolved in 3 vols. of 70% EtOH. *Galangal oil*.—Oils prepd. during the yr. had properties which in some respects did not fall within the limits already known heretofore. They had a spicy odor suggesting cardamom oil or myrtle oil, with d_{15}^{20} 0.915-0.924, $[\alpha]_D^{20}$ -1°30' to -5°30', n_D^{20} 1.476-1.482, acid no. up to 3.6, ester no. 13-17, ester no. after acetylation 40-67, soly. 0.2-0.5 part of 90% EtOH. In 2 oils there were 3% eugenol, of which 25% was found by Hoist in an oil. Over 3% eugenol indicates adulteration. *Geranium oil*.—An oil from Stellenbosch (Cape Colony), probably from *Pelargonium graveolens* Ait., was bright yellow, had d_{15}^{20} 0.8952, $[\alpha]_D^{20}$ -15°55', n_D^{20} 1.4781, acid no. 5.6, ester no. 20.5, ester no. after acetylation 207.2, ester no. after formylation 56.0. In odor it was inferior, even after rectification, to oils from other sources. *Inchi grass oil*, from *Cym-*

bopogon caesius Stapf, had d_{15}^{20} 0.9250, $[\alpha]_D -34^{\circ}25'$, n_D^{20} 1.48895, acid no. 0.9, ester no. 11.2, ester no. after acetylation 98.9, was not completely sol. in 10 vols. of 80% EtOH but was sol. in 0.3 vol. of 90% EtOH (slight opalescence). Its odor did not resemble palmarosa oil, as described by others, but rather Ceylon lemon oil. *Lavender oil* was repeatedly found to contain glyceryl acetate and phthalic ester. The detection of adulteration has recently become more difficult, on account of the addn. of several artificial esters in small quantities. Two oils were apparently adulterated with geraniol and perhaps also with geranyl acetate, though nothing could be ascertained from the constns. An alleged *marjoram* oil showed complete variation in odor and constns. from those of the true oil. Samples of the rind of *Cryptocaria pretiosa* Mart. (*Mespilodaphne pretiosa* Nees et Mart., and *Ocotea pretiosa* Benth et Hook) from Brazil gave on distn. 1.31% of a brown oil with odor resembling cinnamon, d_{15}^{20} 1.1263, $[\alpha]_D -0^{\circ}8'$, n_D^{20} 1.52787, sol in 7.2 vols. of 80% EtOH. *Oil of Nardostachys jatamansi*, obtained in 3.43% yield from roots from Japan, was olive-green with an odor resembling valerian oil, d_{15}^{20} 0.9819, $[\alpha]_D -15^{\circ}15'$, n_D^{20} 1.51790, acid no. 5.6, ester no. 18.7, not completely sol in 10 vols. of 80% EtOH, but miscible in all proportions with 90% EtOH. *Nigella oil*, from the seeds of *Nigella damascena* L. in 0.37% yield, was yellow with strong blue fluorescence, had d_{15}^{20} 0.8985, $[\alpha]_D -4^{\circ}49'$, n_D^{20} 1.49970, acid no. 1.1, ester no. 14.0, ester no. after acetylation 17.7, dissolves in about 15 vols. of 90% EtOH and about 4 vols. of 95% EtOH. *Peppermint oil*. An oil from Chile from cultivated plants had d_{15}^{20} 0.9026, $[\alpha]_D -29^{\circ}42'$, n_D^{20} 1.46638, acid no. 0, ester no. 41.1, ester no. after acetylation 189.5, dissolves to a turbid soln. in about 4 vols. of 70% EtOH and gives a clear soln. with 1.5 vols. of 80% EtOH which becomes opalescent when dild., and has an unpleasant odor, perhaps because of imperfect distn. Two samples of oil from China were similar in odor and constns. to Japanese peppermint oil. Adulteration of peppermint oil was often found, sometimes in a very crude way. A sample of "dementholized" oil bore no relation to peppermint oil, but probably came from a eucalyptus oil. *Rose oil* was in 1 case adulterated with what was probably a lauric acid ester and in another oil a myristic acid ester was identified as an adulterant. *Rose extract oils*, as shown by analysis of numerous samples from different sources, differ from the usual oils obtained by steam-distn. by their high d , n , dextro-rotation, acid no. and ester no. The dextro-rotation does not depend upon non-volatile extractive substances, as shown by distn. Rose ext. oil from fancy roses contained only about 0.5 as much geraniol as that in other grades. Adulteration of *rosemary oil* could be recognized by the odor, and particularly by acetylation. *Sandalwood oil* from western Australia, which sometimes is offered as East Indian oil, differed from the latter in odor and in its optical rotation. PhCH_2OH and terpineol were found as adulterants. *Oil of spike*. An alleged oriental product from London had other properties, and judged by its odor was a white blended camphor oil. *Oil of turpentine*. So-called Strasbourg turpentine from white fir and silver fir from Bolzano had d_{15}^{20} 1.0033, $[\alpha]_D -7^{\circ}22'$, n_D^{20} 1.52359, acid no. 83.1, ester no. 8.4. The oil obtained from it by steam-distn. (in 27.2% yield) had d_{15}^{20} 0.8650, $[\alpha]_D -7^{\circ}15'$, n_D^{20} 1.47211, acid no. 0, ester no. 11.2, dissolves in 6.2 vols. of 90% EtOH. Distn. (at 749 mm. pressure) of oil from *Ladenburg spike* gave 56% at $160-4^{\circ}$, 20% at $164-70^{\circ}$, 9% at $170-80^{\circ}$ and 15% above 180° . A *silver fir turpentine* from Upper Alsace had similar properties. A sample of *cinnamon oil* was found to be only cinnamic aldehyde.

C. C. DAVIS

New developments in the laboratory of Schimmel & Co. SCHIMMEL & Co. *Ber. von Schimmel & Co.* 1926, 133; *Chem. Zentr.* 1926, II, 659-60.—Oil of *Satureja obovata* var. *intricata* Lange (also called *Satureja montana* var. *prostrata* Boiss.) was found in popular use in Spain under the name of *saborilla*. A sample of Spanish oil was deep red-brown, had d_{15}^{20} 0.9386, $[\alpha]_D -3^{\circ}$, n_D^{20} 1.51212 and was sol. in 1.8 vols. of 80% EtOH. It contained 35% phenols, which consisted of carvacrol and thymol. The yield from dry plants was about 0.03%. *Sucupira* kernels from Brazil originated from a kind of pterodons (*P. pubescens*?). On steam-distn. they yielded 1.2% of a pale yellow oil with faint aromatic odor, d_{15}^{20} 0.9064, $[\alpha]_D -77^{\circ}50'$, n_D^{20} 1.50634, acid no. 0, ester no. 11.2, ester no. after acetylation 51.3, sol. in 3 vols. of 95% EtOH but insol. in 10 vols. of 90% EtOH. These data indicate that the oil may be rich in sesquiterpene. *Pterodon*, a legume growing extensively in Brazil, is known there as *sebipira*. C. C. DAVIS

Chemical preparations and drugs. SCHIMMEL & Co. *Ber. von Schimmel & Co.* 1926, 145-66; *Chem. Zentr.* 1926, II, 789-90.—The Schimmel method for the detn. of Cl in BzH is defended against the Faust and Spängler method (C. A. 19, 3446). "Fixoresin" is now prepd. in a large no. of different odors. A geraniol "finest" was

found to be impure, contg. about 30% of an ester of phthalic acid. *Muscone*, a prepn. of musk, in contrast to the probably closely related civetone possesses a ring without an ethylene bond and is therefore very stable toward KMnO_4 , so that it can be for the greater part recovered when steam-distd. and can thus be purified. On oxidation CO_2 and oily partially solidifying acids were obtained. CrO_3 gave an acid of the approx. compn. $\text{C}_{16}\text{H}_{30}\text{O}_4$, m. $53-8^\circ$, b_p 237° , optically inactive; *Ba salt*, *Ag salt* $\text{Ag}_3\text{C}_{17}\text{H}_{32}\text{O}_4$. *Muscone* is perhaps $\text{MeCH}(\text{CH}_2)_7\text{CO}(\text{CH}_2)_6$. With Na and $\text{C}_6\text{H}_{11}\text{OH}$ it is easily re-

duced to the alc. *muscol* $\text{C}_{16}\text{H}_{32}\text{O}$, m. 38° , b_2 in 2 fractions, $153-6^\circ$ and $156-77^\circ$, which is oxidized by boiling CrO_3 or KMnO_4 back to muscone; *IICo₂H ester*, b_p 173.5° ; *phenylurethan*, $\text{C}_{23}\text{H}_{35}\text{O}_2\text{N}$, m. $97-8^\circ$. *Muscone oxime*, converted by warming with fairly concd. H_2SO_4 (4 parts) to *muscone isooxime*, m. $90-95^\circ$. In crude oil of musk, valeric acid was probably identified. The chloral hydrate test for fatty oils in *Peru balsam* requires exact adherence to prescribed proportions and absolutely dry chloral hydrate. The balsam is not miscible in all proportions with vaseline, probably because of the presence of resinotannol esters, and so distinct resinous deposits may be found. A sample of cinnamaldehyde of the correct d., but optically active and unsatisfactory soly., contained 49% aldehyde, the remainder apparently being oil of turpentine or a fraction of the latter.

C. C. DAVIS

Researches on the ethereal oil of Geranium macrorrhizum L. of Bulgaria. PAOLO ROVRSI. *Notiz. chim.-ind.* 2, 438-9(1927).—An oil which has recently become popular in the manuf. of perfumery in Bulgaria is distd. from a plant considered there to be *Pelargonium bulgarica*. Examn. of the plant from this source proved that it is *Geranium macrorrhizum* L., which grows over a wide area in Europe. The oil was semi-fluid, and was composed of a solid cryst. mass in a liquid part. It was yellowish green, and had a characteristic odor. After drying with Na_2SO_4 , the oil m. 28° , had d_{16}^{50} 0.9411, $[\alpha]_D^{30}$ $-3.55'$, n_D^{38} 1.5093, acid no. 0.78, sapon. no. 3.53, sapon. no. after acetylation 28.6, soly. 1 part in 1.2 parts of 90% EtOH at 18° . The solid component of a paraffin nature was insol. in dil EtOH and was purified with this agent. After washing with dil. EtOH, and recrystg. from EtOH it formed lustrous, odorless rhombic crystals, m. $49-50^\circ$, decompd. above 290° to a viscous mass which did not resolidify even when chilled. Deprived of the stearoptene, the oil represented 53% by wt. of the original 2-phase mixt. This liquid portion was greenish yellow, and possessed all the odor of the original oil, d_{23} 0.93622, $[\alpha]_D$ $-7.5'$, n_D^{20} 1.4975, acid no. 1.38, sapon. no. 5.91, sapon. no. after acetylation 61.60, soly. 1 part in 2.1 vols. of 80% EtOH at 20° . It underwent no diminution of vol. with 5% aq. NaOH, gave an immediate violet-red color with Schiff reagent, and shaken 5 hrs. with 30% NaHSO_3 , 18-19% of carbonyl compds. were absorbed. Fractionated under ordinary pressure, it began to distil at 188° and at $220-5^\circ$ partially decompd. This ethereal oil which was sepd. from the paraffin component is being studied further. When the com. oil is added to oil of rose, the characteristics of the latter are changed so little and are so agreeable that it is not a harmful adulteration. The only reference elsewhere to the oil is a recent one (*Ber. Schimmel & Co.*, Aug., 1927, 114-5).

C. C. DAVIS

Great industrial chemical plants. The Sero National Medico-pharmacological Institute. ANON., *Notiz. chim.-ind.* 2, 487-90(1927).—An illustrated description, with portrait of Sero and a bibliography of 58 of his published articles and books.

C. C. DAVIS

Esters of butyric acid as perfumes. A. M. BURGER. *Ruechstoffindustrie* 1926, 131-2; *Chem. Zentr.* 1926, II, 2124.—A description of the chem. and odoriferous properties of a no. of esters of butyric acid, with special reference to phenylpropyl butyrate, cinnamyl butyrate and *p*-cresyl butyrate.

C. C. DAVIS

Oil from immature bitter oranges. PEPPILO LIOTTA. *Rivista ital. essenze profumi* 7, 141(1925); *Chem. Zentr.* 1926, II, 1209.—The oil, which was obtained in low yield from the leaves and twigs of *Citrus bigarade* Risso, was sol. in 2 parts of EtOH, contained 61% esters and gave $[\alpha]_D^{20}$ -6° .

C. C. DAVIS

Influence of the absolute reaction of the soil on the formation and the composition of the essential oil of Marjolaine. HENRY DEEL AND (MMH.) HENRY DEEL. *Bull. soc. chim.* 41, 955-7(1927).—The optimum p_H is in the neighborhood of 9.5. The yield of plant and essence diminishes with decreasing p_H . Variations in p_H are without great influence on the % of essential oil in relation to the plant wt., except in the highly acid range. The optimum p_H is that which yields a max. proportion of total and of free alc. in the essence.

P. R. DAWSON

Sulfur iodide. WALTER ERHARD. *Apoth. Ztg.* 42, 925-6(1927).—A discussion of

this compd. as formerly used in homeopathic preps. of high attenuation, and more recently recommended in allopathic medication. In order to minimize the loss of I in such preps. this element is now introduced in the form of iodized starch. It is thus possible to prep. a S iodide of the 3rd potency having an I content of about 0.8%.

W. O. E.

Estimation of potassium iodide in tincture of iodine. R. WEINLAND. *Apoth. Ztg.* 42, 1228(1927); cf. Warnecke, *C. A.* 21, 3704.—A weighed portion of the sample is evapd. to dryness on the steam bath and the evapn. repeated several times after addn. of a little H_2O until the residue is colorless. It is then weighed.

W. O. E.

Fermentative action of medicinal yeast and certain yeast preparations. TH. SABALITSCHKA AND R. WEIDLICH. *Apoth. Ztg.* 42, 1224-5(1927).—An exptl. study of pharmacopoeial and other preps. of yeast relative to their activity.

W. O. E.

Manufacture of chloral hydrate. ANON. *Pharm. Presse* 32, 381-4(1927).—A detailed description of app. employed, the proportions of chemicals used in the several stages of mfg. $CCl_3CH(OH)_2$.

W. O. E.

Manufacture of salol. ANON. *Pharm. Presse* 32, 293(1927).—A technical procedure is outlined for the manuf. of salol by condensation of salicylic acid and phenol in the presence of $POCl_3$, including a description of the app. needed, the proportions of the several chemicals, and the precise steps involved in producing the pure drug.

W. O. E.

Alkaloids of Aconitum stoerckianum Reichenbach. HEINRICH SCHULZE AND GOTTFRIED BERGER. *Arch. Pharm.* 265, 524-41(1927).—This species possesses a total alkaloidal content of 0.48%. The alkaloids occurring therein appear to be in every respect identical with those already isolated from *Aconitum napellus* L.

W. O. E.

Estimation of atropine in pills. O. IHRISMANN. *Arch. Pharm.* 265, 547-9(1927).—A record of the results obtained in the examn. of aq. exts. of atropine pills when applied to the eyes of cats.

W. O. E.

Fatty oil of ergot. HERMANN MATTHES AND PAUL SCHÜTZ. *Arch. Pharm.* 265, 511-6(1926).—The fatty acids of ergot oil consist of about 28% solid and 72% liquid components, the latter in turn consisting of about 50% hydroxyoleic, 45% oleic and 5% linoleic acids. The hydroxy acid is being subjected to further study.

W. O. E.

Detection of chlorophyll by means of the quartz lamp. P. W. DANCKWORTT AND E. PFAU. *Arch. Pharm.* 265, 560-2(1927); cf. *C. A.* 21, 1328.—Crude drugs in powdered form contg. chlorophyll yield under the analytical quartz lamp a reddish fluorescence when treated with Et_2O . Thus, the color of *Herba lobelia* is red; *Cortex Chinae*, none; *Herba absinthii*, violet-red; *Fructus capsici*, olive; *Radix ipecacuanhae*, blue; *Folia digitalis*, red; *Flores arnicae*, none. Pharm. tinctures show varying fluorescence, as such, and after treatment with Et_2O and H_2O . As small an amt. of digitalis tincture as 0.05 cc. gave a distinct red fluorescence, which persists even after the addn. of 5% ipecacuanha tincture. The fluorescence may perhaps serve in the sepn. of chlorophyll into its 2 components. Thus, on dissolving crude chlorophyll in MeOH and repeated extn. of this soln. with petr. ether, the fluorescence of the MeOH soln. becomes less and less while that of the petr. ether exts. becomes progressively intense.

W. O. E.

Artificial musk, its preparation, application, adulteration and control. ALFRED WAGNER. *Chem.-Ztg.* 51, 646-7(1927); cf. *C. A.* 21, 3705.—The present paper deals specifically with ketone musk, the application of artificial musk infusions and tinctures in perfumery, the adulteration and testing of musk preps.

W. O. E.

Estimation of nicotine in tobacco. L. FRANK. *Chem.-Ztg.* 51, 658(1927).—Into a shaking cylinder (separatory app. of the Röhrig type) of 250-cc. capacity and having a discharge cock between the 60 and 70 cc. marks introduce 10 g. of the finely powd. sample, 10 cc. of 20% KOH soln., and a mixt. of 100 cc. Et_2O and 100 cc. petroleum ether, then shake the closed cylinder $\frac{1}{4}$ hr. vigorously, this treatment being often repeated, whereupon the mixt. is set aside for some hrs. or allowed to stand overnight. Withdraw through the side cock 100 cc. (= 5 g. of the sample) of the completely cleared soln., passing it through a filter charged with fused Na_2SO_4 into an Erlenmeyer flask, the filter being finally washed with some Et_2O -petr. ether mixt., the solvents thereupon distd. and the residual greenish mass extd. with cold H_2O . Filter after standing some time, and titrate with 0.1 N HCl with Congo red as indicator. A sample of Brazilian tobacco (cigar) and another of smoking ("Ehrenstein") tobacco yielded the following values, resp. *via*, Kissling 1.69, 1.69, 1.68; 0.87, 0.85, 0.86%; *via*, Keller 1.65, 1.65, 1.64; 0.83, 0.81, 0.82%; *via*, Toth modified 1.62, 1.64, 1.62; 0.82, 0.83, 0.83%; *via*, Frank 1.65, 1.65, 1.64; 0.83, 0.82, 0.84%. Kissling's procedure requires the longest time, because of the steam distn. prescribed. Keller's method involving extn. with Et_2O - $EtOH$ is convenient and gives good results, provided no loss of nicotine results from evapn. of

the solvents or from dissipation of NH_3 by a stream of air. Furthermore, the titration with iodoosin is not always exact. Finally, losses may occur in Rundhagen's modification of Toth's method during the H_2O filtration. W. O. E.

Detection and estimation of thymol. F. W. KLINGSTEDT AND F. SUNDBSTRÖM. *J. prakt. Chem.* 116, 307-13(1927).—The fact that the Me and Et ethers of thymol lend themselves under suitable conditions to nitrosation affords a means for the detection of thymol in the presence of carvacrol, which under like treatment fails to yield a nitroso deriv. The same reaction may also be used to det. thymol quantitatively. Thus, if 2 g. of thymyl methyl ether is dissolved in 30 cc. of EtOH and 4 cc. of AcOH the soln. is thereupon satd. with HCl followed by addn. of 1 g. NaNO_2 in 2 g. of H_2O , a ppt. of nitrosothymol will be formed, which can then be washed and weighed. A mixt. of carvacrol and thymol yields after methylation and nitrosation as above nitrosothymol in the same proportion as this substance is present. W. O. E.

Cyprus otto of rose. W. H. SIMMONS. *Perfumery Essent. Oil Record* 18, 346 (1927).—The consts. obtained in the examn. of a sample of oil recently distd. at the Kykko Monastery, Cyprus, are compared with values yielded by an oil prepd. in 1922 under the direction of the Greek Minister of Agriculture, likewise with those giving the usual range for Bulgarian otto. The comparative values are, resp.: d_{20} 0.875, 0.8724, 0.850-0.860; α $-2^\circ 0'$, $-2^\circ 0'$, $-1.5-4^\circ$; n_{25} 1.4697, 1.466, 1.458-1.465; congealing pt. 16.5, 16.0, 18-23°; m. 18.0, —, 19-24.5°; sapon. no. 18.0, 16.5, 7-18; ester no. as linalyl acetate 6.3, 5.7, 2.5-6.3; citronellol 32.6, —, 30-40%; stearoptene 7.3, —, 14-20%; m. p. of stearoptene 32.5, —, 32-34°. While this sample of Cyprus otto has a relatively high d. and n as might be expected with so small an amt. of stearoptene as 7.3%, there is a greater proportion of elcoptene, the odorous constituents of the oil and hence a greater odor value. This is confirmed by its particularly powerful odor, which is at the same time very sweet and fragrant. W. O. E.

Sandalwood oil and the B. P. K. B. MAVLANKAR. *Perfumery Essent. Oil Record* 18, 347(1927).—It is shown by documentary evidence that the only sandalwood oil which is recognized by the Brit. Pharm. is the oil distd. from *Santalum album*, Linn., alone, and that the Australian product is not a B. P. oil. W. O. E.

Fluid extracts from domestic drug plants. LUDWIG KROEBER. *Pharm. Zentralh.* 68, 23-5, 36-8, 163-5, 374-6, 452-5, 518-20, 609-11(1927); cf. *C. A.* 19, 871; 20, 3060.—A continuation of similar studies on *Ext. Pulmonariae officinalis* (d_{19} 1.02, dry residue 15.30%, ash 3.70%); *Ext. foliorum Potentillae anserinae* (d_{19} 1.077, dry residue 27.60%, ash 3.90%); *Ext. Linariae vulgaris* (d_{19} 1.066, dry residue 24.53%, ash 2.95%); *Ext. Fumariae officinalis* (d_{19} 1.106, dry residue 28.35, ash 4.30%); *Ext. Agrimoniae eupatoriæ* (d_{19} 1.055, dry residue 18.78%, ash 1.65%); *Ext. foliorum Juglandis* (d_{19} 1.029, dry residue 15.45%, ash 2.15%); *Ext. Urticae dioica* (d_{19} 1.024, dry residue 12.45%, ash 2.25%). The extrn. liquid was a mixt. of 3 pts. of EtOH and 7 pts. of H_2O . A bibliography accompanies each article. W. O. E.

Manufacture of bismuth salts. F. CHEMNITIUS. *Pharm. Zentralh.* 68, 513-8 (1927).—The prepn. of the more important salts of Bi used in pharmacy and medicine is outlined in considerable detail. W. O. E.

Calcium-salicylic acid therapy. ERICH HERRMANN. *Pharm. Zentralh.* 68, 497-9 (1927).—An account of various attempts to develop a compd. involving the therapeutic properties of Ca and salicylic acid and possessing reasonable stability. Attention is directed especially to a recent new drug, agit, which is essentially a mixt. of the Ca salts of salicylic and lactic acids. W. O. E.

Plant alkaloids in chemistry and pharmacy. K. H. BAUER. *Pharm. Zentralh.* 68, 529-36(1927).—A discussion. W. O. E.

Drug synthesis and specialties. H. P. KAUFMANN. *Apoth. Ztg.* 42, 944-7(1927).—A discussion. W. O. E.

Color reactions of certain phenols with aldehydes. LAD. EKKERT. *Pharm. Zentralh.* 68, 563(1927).—The color reactions resulting from the admixt. of CH_2O , $(\text{C}_2\text{H}_4\text{O})_2$, $\text{C}_6\text{H}_5\text{CHO}$, furfural, sucrose, BzH , PhCH_2CHO , anisaldehyde, salicylaldehyde and cinnamaldehyde, vanillin, piperonal and citral, resp., with resorcinol, hydroquinone, orcinol, pyrogallol, phloroglucinol, α - and β -naphthols, PhOH , thymol, carvacrol, pyrocatechol, guaiacol, guaiacol carbonate, eugenol and creosol are summarized in considerable detail. The tests are carried out by mixing 4 drops of a 1% phenolic soln. in 96% alc. with 4 drops of a 1% soln. of the aldehyde in 96% alc. and adding thereto 0.5 cc. of concd. H_2SO_4 . W. O. E.

Color reactions of essential oils and certain of their constituents. LAD. EKKERT. *Pharm. Zentralh.* 68, 577-83, 593-602(1927).—The manner of application and reagents

were similar to or identical with those used in the preceding study. The color changes obtained with a large no. of oils are presented in tabulated form. W. O. E.

Chenopodium oil. H. THOMS. *Pharm. Ztg.* 72, 1123-4 (1927).—A discussion of American wormseed oil from the standpoints of exhibition and pharmacopoeial recognition. W. O. E.

Isolation of nicotine from *Nicotiana attenuata*. Torr. J. F. Couch. *Am. J. Pharm.* 99, 519-23 (1927).—Detn. according to the method of Young (*C. A.* 21, 1077) showed the presence of total alkaloid calcd. as nicotine in the dried plant as follows: leaves 1.45, stems 0.48, and roots 0.25%. According to results obtained by Chapin's method (*C. A.* 6, 529) there is apparently no nonvolatile alkaloid present. Nicotine was isolated and found identical chemically and pharmacologically with nicotine from *N. tabacum*. The lethal dose of nicotine injected intraperitoneally in guinea pigs was detd. as 17 to 20 mg./kg. W. G. GAESSLER

Studies in the genus *Mentha*. XIII. An examination of an oil of *Mentha piperita* L. produced in 1924. S. M. GORDON. *Am. J. Pharm.* 99, 524-30 (1927); cf. *C. A.* 18, 1178; 20, 92, 1301, 3212.—The present investigation of the oil from a known strain of *Mentha piperita* L. grown at Madison, Wis. has revealed the following: Only 13% of the free menthol can be "frozen out" in spite of the fact that the oil contains about 50% free and combined menthol. The presence of the previously described compds. was confirmed, viz. *l*-menthone, *d*-pulegone, *l*- α -pinene. The presence of *d*-menthone and a terpinene not previously reported was established. The 1924 oil contains neither phellandrene nor limonene as previously reported. W. G. GAESSLER

An improved apparatus for testing the activity of drugs on the isolated uterus. II. P. S. PITTENGER. *Am. J. Pharm.* 99, 531-8 (1927); cf. *C. A.* 8, 3097; 12, 2585; 17, 3569.—P. has designed a new app. which, although essentially the same in general principle as the various forms of app. described in previous publications, has many improvements which lead to greater accuracy and simplicity of operation. A brief description of this app. and the assay method are supplemented with photographs and graphic drawings. W. G. GAESSLER

Properties and constituents of an oil extracted from the seeds of *Digitalis purpurea*. I. S. MELLANOFF. *Am. J. Pharm.* 99, 549 (1927); cf. *C. A.* 21, 3706.—An amber-colored oily liquid having a peculiar fatty odor and a bland taste; n_D^{20} 1.4755, sp. gr. 0.9231 at 15.5°, acidity-figure 9.3, sapon. no. 207.5, ester figure 198.2, unsaponifiable matter 6.12%, sol. fatty acids 1.66%, insol. fatty acids 90.0%, hydroxy fatty acids none, volatile fatty acids 4.8 cc. 0.1 N Ba(OH)₂, liquid fatty acids 75.8%, n_D^{20} of liquid fatty acids 1.4670, solid fatty acids 9.2%, n_D^{20} of solid fatty acids 1.4685, glycerol 11.4%, I no. (Hanus) 127.9. W. G. GAESSLER

New technical progress in disinfectants. W. H. GESELL. *Am. J. Pharm.* 99, 555 61 (1927).—A review and discussion. W. G. GAESSLER

The loss of morphine in powdered opium by keeping; its causes and prevention. A. C. ABRAHAM AND J. RAE. *Am. J. Pharm.* 99, 570-84 (1927). See *C. A.* 21, 154. W. G. GAESSLER

The new medicinal products of the year 1926. J. HERZOG. *Deut. med. Wochschr.* 53, 967-9 (1927).—A review of the following compds.: synthalin, plasmochin, vigantol, dilaudid, betilon, bulbocapnine and ephedrine. ARTHUR GROLLMAN

Report of the essential oil sub-committee on uniformity of analytical methods. JOHN ALLEN, et al. *Analyst* 52, 530 (1927); cf. *C. A.* 21, 2758.—Recommendations with respect to sp. gr., refractive indices, optical rotation and statement of temps. W. T. H.

The development of pharmaceutical synthesis. WERNER SCHULEMANN. *Naturwissenschaften* 15, 633-6 (1927).—A review. B. J. C. VAN DER HOEVEN

Results of investigation of remedies, patent medicines, cosmetics and similar products. C. GRIEBEL AND F. WEISS. *Z. Untersuch. Lebensm.* 53, 545-8 (1927); cf. *C. A.* 20, 2722.—A report of ingredients found in various preps. W. J. H.

Conditions for the extraction of the active glucosides of *Adonis vernalis*. G. A. PEVZNER. *Trans. Sci. Chem.-Pharm. Inst.* 1923, No. 3, 78-84 (1923).—Extn. in a Soxhlet with abs. alc. and percolation with MeOH and EtOH give good standardized products and all of the active principle is extd. Prolonged extn. with water (20 times) also takes out all of the active principle. The alc. does not influence negatively the glucosides; on the contrary it increases its activity (formation of anhydrous forms). Heating to 100° weakens somewhat the action of the glucoside. J. S. JOFFE

The scope of the scientific chemico-pharmaceutical institute for the study of essential oils and perfumes. B. N. RUTOVSKII. *Trans. Sci. Chem.-Pharm. Inst.* 1923, No. 4, 3-9. J. S. JOFFE

The problem of the constants of Russian mint oil. B. N. RUTOVSKII AND I. V. VINOGRADOVA. *Trans. Sci. Chem.-Pharm.* 1923, No. 4, 10-13.—Some of the mint oil produced in Russia showed the following consts: $[\alpha]_D = -20^\circ$ to -27° , d_4^{15} 0.914-0.915. The quantity of menthol in the form of ethers is 6-15%, free menthol 41-51%, menthone 16-18%, acid number 0.7-1.0. Methods of extrn. are described. J. S. JOFFE

Constituents of Russian fennel oil. B. N. RUTOVSKII AND P. P. LEONOV. *Trans. Sci. Chem.-Pharm. Inst.* 1923, No. 4, 16-24.—Russian fennel oil contains about 55% anethole, *d*-fenchone, *d*- α -pinene, dipentene, α -phellandrene, camphene and anisaldehyde. The methods of sepg. the various fractions are described. J. S. JOFFE

Constituents of essential oil of *Artemisia maritima* not containing santonin. B. N. RUTOVSKII AND S. A. BUSSE. *Trans. Sci. Chem.-Pharm. Inst.* 1923, No. 4, 25-33.—It contains 27.8% cineole and 7-8% β -thujone. The presence of camphene has been demonstrated; α -pinene, β -pinene, phellandrene and terpene are absent. The presence of limonene and dipentene is doubtful. The methods of obtaining the fractions are given. J. S. JOFFE

Bibliographical essay of odoriferant plants and oils. B. N. RUTOVSKII. *Trans. Sci. Chem.-Pharm. Inst.* 1923, No. 4, 34-52.—A bibliography of approx. 500 titles, in Russian. J. S. JOFFE

Crimean plants containing essential oils. B. N. RUTOVSKII. *Trans. Sci. Chem.-Pharm. Inst.* 1923, No. 8, 5-32.—R. gives a list of plants contg. ethereal oils which can be raised in Crimea, Russia. Illustrations of the plants are given, as well as the nature of the oils which can be extrd. J. S. JOFFE

Spinal anesthesia with anhydrous cocaine. Observations on 557 additional cases. J. R. WELLS. *Ann. Surgery* 85, 757-64(1927).—Cocaine crystals (1 g.) were dissolved in 25 cc. abs. alc. after 3 to 4 hrs. 150-200 cc. dry ether was added; a crystalline ppt. was formed. The supernatant liquid, when siphoned and evapd. gave a light brown residue which formed in flakes, was hygroscopic, sol. in water or spinal fluid and non-toxic. This anhydrous cocaine gave good results when used as an anesthetic. F. K.

The chemistry of "Sanguis Draconis" from *Dracaena draco*. SIGMUND FRANKEL AND ERICH DAVID. *Biochem. Z.* 187, 146-58(1927).—"Sanguis Draconis" is a red dye from the resin obtained from fruit of *Dracaena draco*. It has a compn. corresponding to the formula $C_{17}H_{18}O_4$, and is an unsatd. compd. whose ozonide on hydrolysis yields a dicarboxylic acid, $C_{12}H_{22}O_8$. On oxidation with dil. HNO_3 there are formed a keto acid, *dracaenic acid*, $C_{11}H_{11}O_5 \cdot CO_2H$, m. 120° (hydrazone m. 204°), and *dracotic acid*, $C_8H_9O_5 \cdot CO_2H$, sublimes 130° , crystallizes from water with $4H_2O$, m. 178° (Et ester, $C_7H_{10}O_6$, m. 154° , Ba salt), forms no hydrazone nor oxime. S. MORGULIS

The bitter principle of *makabuhay*, *Tinospora rumphii* Boerlage. JOAQUIN MARANON. *Philippine J. Sci.* 33, 357-61(1927).—This plant is indigenous in the Philippines and is considered a valuable remedial agent. The bitter principle was extrd. by boiling the freshly sliced stems with water for 30 min., decanting the liquid and repeating the process several times. The combined aq. exts. were evapd. and the residue was extrd. with boiling 95% alc. After many treatments and purifications a white powder was obtained, sol. in alc., slowly sol. in water and insol. in Et_2O or $CHCl_3$, m. $154-155^\circ$. It appears to be a glucoside of the compn. C 41.15, H 11.67, O 47.18. L. W. RIGGS

The system bromural-pyramidone. HÅKAN SANDQVIST AND WALDEMAR HÖK. *Svensk Farm. Tids.* 51, 377-81, 393-6(1927).—Two series of mixts. of bromural and pyramidone were submitted to Rheinboldt's method (C. A. 20, 693). When plotted the two were in very good agreement and showed that these two substances remain as a mixt. and do not combine. The eutectic point comes at 42.8% bromural and 80.8°. The "thaw" curve passes 5.5° below the eutectic point and approximates the horizontal line only between 25 and 79% bromural. A. R. ROSE

A forgotten Turkish pharmacopeia. J. ZANNI. *Chemist & Druggist* 106, 470 (1927).—The work referred to is the Ottoman Military Pharmacopeia, compiled by C. A. Bernard, Constantinople-Pera, 1844, in Latin and French. S. WALDBOTT

The purity of ether. F. A. HOCKING. *The London Hospital Gazette, Chemist & Druggist* 106, 592(1927).—Ether of the highest grade of purity is now considered to give the best results in anesthesia. To test for peroxides in Et_2O , add to 5 cc. Et_2O 1 cc. 0.1 N KCNS and 1 drop of freshly prepd. 5% soln. of $FeSO_4 \cdot (NH_4)_2SO_4$. A pink color is produced at once if peroxides are present. The test is sensitive to 1:1,000,000. S. WALDBOTT

Hygienic mouth washes. J. AUGUSTIN. *D. Parf. Ztg.* No. 5, 1927; *Schweiz. Apoth. Ztg.* 65, 243-5(1927).—Discussion and formulas. S. WALDBOTT

Glycerol-kaolin paste in gynecological therapeutics. H. GALMIER. *J. pharm. d'Alsace Lorraine* 54, 15-7(1927).—The formula glycerol 20 kg., kaolin 30 kg., I 3.5

g., H_3BO_3 45 g., salicylic acid 9 g., essence of peppermint, eucalyptus, gaultheria, 6 g. of each is suggested; the indications and mode of application are described. S. W.

Analogy between two sirups having ferrous salts as a base. SCHISSELÉ. *J. pharm. d'Alsace Lorraine* 54, 99-100(1927).—Sirup of FeI_2 turns brown in the dark, not because of formation of free I, as it does not turn blue with starch; FeI_2 is partly oxidized in the dark, but exposure to direct sunlight restores the green color. Similarly, sirup of Ca and Fe lactophosphate in the dark forms a flaky ppt. of $\text{FePO}_4 + \text{Fe}_2\text{O}_3$, but becomes limpid again in sunlight, the ferrous salt being restored. S. WALDBOTT

Applied pharmacognosy: Congo cubebs. L. ROSENTHALER. *Pharm. Acta Helv.* 2, 29-30(1927).—Congo cubebs, a substitute for genuine cubebs in the Hamburg market, are identical in their morphological and anatomical characteristics and in their chem. behavior towards H_2SO_4 with the fruits of *Piper guineense* Schumann. S. W.

Determination of the theobromine content of theobromino-sodium salicylicum. JULIUS VON MIKÓ. *Pharm. Acta Helv.* 2, 51-2(1927).—Dissolve 1 g. of the salt in 5 cc. H_2O in a porcelain dish, add 20 cc. of 96% EtOH and 5 drops of 5 N HCl. Allow to stand for 10 min., stirring repeatedly. Bring the ppt. upon a filter moistened with alc., rinse the dish with 2×10 cc. 96% EtOH, and dry the ppt. to const. wt. The yield should be at least 0.40 g., and the ppt. should readily give the murexide test. In the place of EtOH, a mixt. of equal vols. of Et_2O and 96% EtOH may be used. S. WALDBOTT

A rare admixture noted in succus liquiritiae depuratus. AXEL JERMSTAD. *Pharm. Acta Helv.* 2, 52-3(1927).—Crystal sand insol. in H_2O , observed in a certain lot of purified licorice juice, proved to be $\text{Mg}(\text{NH}_4)\text{PO}_4 \cdot 6\text{H}_2\text{O}$. The component parts of this substance are naturally contained in licorice root. S. WALDBOTT

Stomatal numbers, their value for distinguishing species. HELEN A. TIMMERMAN. *Pharm. J.* 118, 241-3(1927).—An attempt to base differentiation of several species of *Datura* on the actual no. of stomata per sq. mm. of the upper or lower epidermis of a leaf, was largely unsuccessful; only with *D. innoxia* an apparent regularity was noted. S. WALDBOTT

The Scarborough herb garden. Report for 1926. H. M. HIRST. *Pharm. J.* 118, 298-300(1927).—A report on the cultivation of 46 medicinal plants for sale to students in pharmacy. S. WALDBOTT

A note on iron and ammonium citrate, Brit. Pharm. F. J. TODD. *Pharm. J.* 118, 731, 790; *Chemist & Druggist* 107, 22-3(1927).—This compd. (A) in aq. soln. may remain clear on standing or may ppt., depending on whether the soln. is neutral or distinctly acid. The non-pptg. soln. contained 6.39-6.97% NH_3 , the pptg. soln. 5.51% NH_3 . The next Brit. Pharm. should require the aq. soln. of A to be neutral, or very faintly acid or alk. to litmus, and the quantity of NH_3 present should be not less than 6.9% NH_3 . The frequent addn. of MgSO_4 to A in prescriptions causes in aq. soln. the reversed conditions of pptn. or non-pptn.; those distinctly acid remain clear, those neutral ppt. on standing. S. WALDBOTT

The official preparations of cinchona barks. F. J. TODD. *Pharm. J.* 118, 731-4; *Chemist & Druggist*, 107, 23-4(1927); cf. Bennett, *C. A.* 18, 149.—Cinchona bark should be assayed for its total alkaloidal content only, omitting the (official) sep. detn. of quinine and cinchonine. The Brit. Pharm. assay method gives low results. A new assay method proposed is based on the fact that an alc.- NH_3 menstruum completely removes the total alkaloids by percolation or hot extn. Treat 5 g. of the bark in No. 60 powder by hot extn. with a mixt. of 97.5 vol. of 90% alc. and 2.5 vol. of strong NH_3 soln. Evap. the liquid, to which 2 cc. glycerol is added, to about 10 cc., transfer to a separator, washing the basin with a mixt. of 5 cc. (or less) each of H_2O and alc.; then add 10 cc. N KOH, ext. the alkaloids repeatedly with Et_2O contg. 5 cc. alc., wash the united Et_2O solns. with 20 cc. dil. NH_4OH , then ext. with dil. HCl, add NH_3 , and transfer the alkaloids into CHCl_3 , wash with a little H_2O and evap. to const. wt. The Brit. Pharm. cinchona preps. are criticized for incomplete extn. of alkaloids and lack of uniformity in appearance and behavior when dispensed. It is suggested to introduce a soft ext. of cinchona standardized as to its total alkaloidal content and prepd. according to a process based on the above method of assay of the bark. From this soft ext., the fluid ext., tinctures and infusions may be prepd. according to formulas given. Tables are included showing the results of analyses of com. samples of liquid ext. of cinchona, the assay of cinchona bark by different methods, and comparison of results in prepg. samples of the liquid ext. and tincture of cinchona by the official and proposed methods, indicating the % of total available alkaloid extd. in each case. Thus, e. g., liquid ext. and tincture gave, resp., 55.1 and 60.7% yield; by the proposed soft ext. method, 92.1%

yield. Further extn. of the 3 (dried) marcs yielded, resp., 43.9, 35.7, 7.05%.

S. WALDBOTT

Sulfur sublimatum. C. OLIVE GRIFFITHS. *Pharm. J.* 118, 734-5, 791; *Chemist & Druggist* 107, 24-5(1927).—Several samples of genuine sublimed S have been examd., and a simple method for detg. the % sol. in CS_2 is given. The globules characteristic of sublimed S consist of a sol. portion (70.92-81.68%) assocd. with an insol. part. An admixt. of ground S to sublimed S may be detected by the presence of colorless, sharply angular (not yellow, subangular) particles which are abundant in ground S. Finally, modifications in the Brit. Pharm. monograph on S are suggested. S. WALDBOTT

Stramonium and other species of Datura: A comparative study of the structure of their leaves. HELEN A. TIMMERMAN. *Pharm. J.* 118, 735-91; *Chemist & Druggist* 107, 25-6(1927).—A detailed botanical description, with macroscopical and microscopical sketches of the leaves of *Datura stramonium* Lin., *D. tatula*, Lin., *D. innoxia*, Miller, *D. metel*, Lin. and *D. fastuosa* Lin. A key for the identification of the powd. leaves of these species is given, also a list of 15 references. S. WALDBOTT

Stramonium and other species of Datura: A comparative study of the structure of their seeds. HELEN A. TIMMERMAN. *Pharm. J.* 118, 742-6, 791-2; *Chemist & Druggist*, 107, 26-7(1927).—Botanical description with sketches of microscopical sections of the seeds of 5 species of *Datura* (see preceding abstr.). A key for distinguishing the powd. seeds of these species is given, also a list of 10 references. S. WALDBOTT

Tragacanth and its mucilage. II. NORMAN EVERS AND THOMAS McILACHLAN. *Pharm. J.* 118, 746-7, 792; *Chemist & Druggist*, 107, 27-8(1927); cf. C. A. 18, 3103; 21, 3710.—Considerable deterioration takes place in tragacanth on keeping, as judged by the strength of the mucilage prepd. from it. The process is hastened by drying (e. g., over H_2SO_4), and is prevented by keeping in a moist atm. Mucilages made in the cold after keeping for a year, have a better suspending power than those made by heating. S. WALDBOTT

Note on the identification and determination of morphine in compound tincture of camphor. C. M. CAINES. *Pharm. J.* 118, 751-2, 792; *Chemist & Druggist* 107, 28 (1927).—The KIO_3 color reaction with morphine (A) allows quite accurate and rapid detn. of very small quantities of A in official liquors contg. A, as well as the detn. of A in ampoule preps., pills and tablets. With official solns. no preliminary treatment is necessary. Adjust the given soln. to approx. 0.002 g. A in 10 cc., add 10 drops of $\text{N H}_2\text{SO}_4$, 10 drops of a satd. soln. of KIO_3 , allow to stand for 5 min., add 10 drops of strong NH_3 soln., and at the end of 2 min. compare the color produced with that obtained from a standard soln. of A treated similarly. In the case of compd. tincture of camphor, Brit. Pharm. (B), contg. in the form of tincture of opium 0.05 g. A in 100 cc., add to 20 cc. B 1 to 2 drops of dil. AcOH , evap. to dryness on a water bath, dissolve in 10 cc. 60% EtOH , evap., dissolve the residue in 10 cc. H_2O , add slight excess of $\text{Pb}(\text{AcO})_2$, bring to 20 cc.; to an aliquot add Na_2HPO_4 , filter, render an aliquot of the filtrate alk. with KOH , and ext. any non-A alkaloids present, with 3×10 cc. Et_2O . These may be examd. after evapn. of the Et_2O . Wash the alk. liquid with CHCl_3 , then mix with NH_4OH and ext. A by the method of Nicholls (C. A. 17, 850), i. e., with an alc. CHCl_3 mixt. (1:1 then 3 or $4 \times 0.5:1$); evap., dry at 100° , weigh, then add 10 drops of $\text{N H}_2\text{SO}_4$ and finish the detn. of A as before. The KIO_3 test is sp. for A except in presence of *psychotrine* (Yodd, in discussion, *Ibid* 792); however, this alkaloid will be removed in the preliminary treatment with Et_2O . S. WALDBOTT

Carbolic acid suppositories, Brit. Pharm. 1914. HARRY BRINDLE AND L. H. BOARDMAN. *Pharm. J.* 118, 760-1, 793; *Chemist & Druggist* 107, 34(1927).—The official process is unsatisfactory, as the presence of white wax requires excessive heating of the mixt. of oil of theobroma and PhOH to melt the wax; this excess of heat greatly delays the solidification of the suppositories. Conversely, it was proved that wax used in the Brit. Pharm. quantity was of no advantage in retarding the softening upon slowly raising the temp., as samples prepd. without wax remained firm at temps. at which those made with wax had softened. A satisfactory procedure is as follows: Take PhOH , 0.8 g.; oil of theobroma, a sufficient quantity for 12 suppositories. Melt the oil of theobroma and powder the PhOH ; allow the oil to cool, with continuous stirring until it shows signs of solidification by becoming less transparent (at about $25-26^\circ$); add the powd. PhOH , stir until dissolved, and pour the melted mixt. into suitable molds. S. WALDBOTT

A new method of locating the end-point in alkaloidal titrations. C. MORTON. *Pharm. J.* 118, 761-3, 794; *Chemist & Druggist*, 107, 39(1927).—The paper describes a simple device by means of which the end-point of alkaloidal titrations and of other reactions may be detd. electrometrically without the use of a potentiometer. The de-

flections of a galvanometer used in conjunction with a thermionic valve give directly the $\Delta E/\Delta V$ values required for constructing the differential titration curve of Hostetter and Roberts (*C. A.* 13, 2319). Unlike the arrangement of Goode (*C. A.* 16, 665), which is intended only for rough measurements, the equivalence point is located with a degree of accuracy equal to that of the potentiometric method. The method differs from the differential titration methods of Cox (*C. A.* 19, 2610) and of MacInnes and Jones (*C. A.* 21, 367) in the rapidity with which the titration is carried out, and in the improved sensitivity due to the amplifying properties of the valve. S. W.

The extractive of ginger. J. R. WALMSLEY. *Pharm. J.* 118, 763-4, 792; *Chemist & Druggist* 107, 29-30(1927).—Results of the detns. of alc. and aq. exts. and ash, of African, Cochin and Jamaica gingers are tabulated. They show that the Brit. Pharm. requirement of a min. of 5% for alc. ext. excludes 10 out of 15 samples of the best grades of Jamaica ginger while admitting all of the African, and 70% of the Cochin samples. It ignores the equally valuable aromatic, oily part which predominates in the oleoresin of Jamaica ginger, and which is volatilized on evap. the alc. soln. Scraped, unleached Jamaica ginger should exclusively be used in pharmaceutical preps. In the Brit. Pharm. the figure for alc. ext. should then be reduced to 3.5-4%, or omitted altogether, as in U. S. P. S. WALDBOTT

A supplementary paper on official astringent drugs. A. H. WARE. *Pharm. J.* 118, 764 7, 793-4; *Chemist & Druggist* 107, 34 5(1927); cf. *C. A.* 20, 93; 21, 155.—Descriptions and analytical results are given of 3 com. red gums from authentic botan. sources; *i. e.*, kinos from *Eucalyptus rostrata*, *E. calophylla* and *Angophora lanceolata*. H₂O, resp., 12.85, 10.42, 8.81%; soly. in alc. 80.77, 81.44, 84.81%; soly. in hot H₂O 87.05, 85.38, 79.59%; residue insol. in H₂O 0.1, 4.2, 11.6%; ash 0.56, 0.67, 0.48%. More exact details are also given of processes of extn. of, and tests for certain tannin-bearing materials previously dealt with. S. WALDBOTT

The detection of carboic acid in commercial cresols. A. H. WARE. *Pharm. J.* 118, 775-6, 794; *Chemist & Druggist*, 107, 35-6(1927).—The Brit. Pharm. test for the detection of PhOH in cresol is useless, as it fails to indicate added PhOH. A new method of testing is described, involving (1) the sepn. of partially purified PhOH from cresol by shaking out with a limited quantity of alkali: To 10 cc. of the "cresol" mixt. add 10 cc. 0.1 N KOH, shake, centrifuge and remove the upper phenate layer, from which shake out free PhOH with Et₂O; reject this soln. Acidulate the phenate layer and shake out the PhOH with Et₂O, evap. the soln. (2) Apply to the residual PhOH the crimson or purple color test with NaNO₂ (*C. A.* 21, 2635). In the absence of PhOH, only a non-distinctive, reddish color is formed, turning brown with NH₄OH. S. W.

Spiritus aetheris and spiritus chloroformi; the variation of the specific gravity with the proportions of the ingredients. F. H. MILNER. *Pharm. J.* 118, 776-7, 794; *Chemist & Druggist* 107, 36-7(1927).—The sp. grs. of mixts. of CHCl₃ and 90% alc., and of Et₂O and 90% alc. have been detd. With CHCl₃, a slight expansion takes place; with the Et₂O mixts., considerable contraction is noted. The object of the expts. was to ascertain whether a simple detn. of sp. gr. was a sufficient indication of the concn. of these spirits. The results illustrated by graphs show that the sp. gr. is a reliable index of the compn. of the mixt. S. WALDBOTT

Biological methods in modern pharmacy. B. E. READ. *Pharm. J.* 119, 3-5 (1927).—An address on biol. standardization of drugs. S. WALDBOTT

The ambiguities of pharmacopeial nomenclature. A. J. SOMER. *Pharm. J.* 119, 7 9(1927).—A plea for conciseness and uniformity of statement in the directions and tests for identity and purity of drugs and preps. in the forthcoming Brit. Pharm. Cf. F. C. J. Bird, *Ibid* 118, 589(1927). S. WALDBOTT

Liquid extract of belladonna. F. J. TODD. *Pharm. J.* 119, 31(1927).—An exptl. crit. examn. of Franklin's new process of prepn. (cf. *C. A.* 21, 1522, 3424). The theoretical yield of alkaloids claimed for F.'s method, could not be obtained; at most only 77.2% was recovered. Certain more definite directions of procedure should be given. S. WALDBOTT

The melting point of barbitone. G. J. W. FERREY. *Pharm. J.* 119, 31-2(1927).—The m. p. of barbitone, given by Brit. Pharm. at 191°, by U. S. P. X "between 187 and 190°", after recrystn. from different solvents varied from 189.2 to 189.7° (alc., abs. and dil.), 189.6° to 190° (redistd. C₆H₆), 189.5° to 190.0° (hot H₂O). Limits of 189.0° to 190° for com. and purified barbitone are suggested. S. WALDBOTT

Chinese medicine. ADAM CLARK. *Pharm. J.* 119, 137-9(1927).—A detailed review of ancient Chinese medicine, materia medica and practical pharmacy. S. W.

The constituents of crude drugs. III. Essential oils. J. E. DRIVER and G. E. TREASE. *Pharm. J.* 119, 164-7(1927); cf. *C. A.* 21, 3253.—A review of essential oils,

with graphic formulas of their characteristic terpenes, alcohols, aldehydes, ketones, phenols and phenolic ethers. A summarizing table classifies the essential oils of the Brit. Pharm. according to their principal constituents. S. WALDBOTT

Lucky Tiger. ANON. *J. Am. Med. Assoc.* 89, 541(1927).—Analysis showed d_{20} 0.9414, Na salicylate 0.47, NaAsO_2 0.15, EtOH 37.74, MeOH 8.7%. Recommended for treatment of dandruff and falling hair. L. E. WARREN

Harrell Associated Chemists Rheumatism Treatment. ANON. *J. Am. Med. Assoc.* 89, 637(1927).—The treatment consists of 6 gelatin globules, 4 tablets and 4 pink capsules. The globules contained Me salicylate, the tablets cinchophen, while the capsules contained NaHCO_3 colored pink. L. E. WARREN

Weldona for Rheumatism. ANON. *J. Am. Med. Assoc.* 89, 1167(1927).—Various analyses of this prepn. have appeared. The "treatment" formerly consisted of lavender-coated tablets and white tablets. The white tablets have been reported to contain ext. of cascara. The lavender-colored tablets have been reported variously to contain Na salicylate, unidentified vegetable extractive, salicylic acid, acetylsalicylic acid, emodin-bearing drug extractives, cinnamon and ginger. A recent analysis indicated salicylic acid, acetylsalicylic acid, phytolacca and cascara. Alkaloids were absent. Neocinchophen was not identified. L. E. WARREN

A. R. C. Epilepsy Remedy. ANON. *J. Am. Med. Assoc.* 89, 1167-8(1927).—The remedy consists of 30 capsules. Each capsule contains about $1\frac{1}{2}$ grains of phenobarbital, a considerable amt. of an emodin-bearing drug and a dye. L. E. WARREN

The potency of various samples of digitalis grown in British Columbia. M. I. SPARKS. *J. Am. Pharm. Assoc.* 16, 203-9(1927).—Plants grown in Brit. Columbia only a yr. or two from the wild state were studied. Some of the plants had been fertilized with NaNO_3 , others not. *Digitalis purpurea* with purple bloom, *D. purpurea* with white blooms and *D. lutea* leaves were assayed by the U. S. P. X 1-hr. frog method and by the Magnus-Wyngaarden method (C. A. 20, 2706, 3511). For comparison a standard sample grown in England standardized for com. use and a standard sample supplied by the Int. Conf. for Bio. Prod., as prepd. by Magnus, were used. Tinctures and infusions were tested. The results by the 2 methods were not strictly comparable. This confirms the observations of other workers. By the cat method the white- and purple-flowered varieties gave about the same values, the white being possibly a little stronger; by the frog method the white-flowered variety was definitely weaker. A mixed sample of the Canadian drug was almost as potent as the standard English-grown leaf. *D. lutea* is stronger than *D. purpurea* by both methods, the difference being more striking by the cat method. The drug which had been fertilized was about 40% more potent than the unfertilized leaf and the yield of leaf per acre was increased about 15%. L. E. WARREN

A phytopharmacological study of digitalis assay. D. I. MACHT and J. C. KRANTZ, JR. *J. Am. Pharm. Assoc.* 16, 210-8(1927). See C. A. 21, 2960. L. E. WARREN

The U. S. P. X nitrate test as applied to solution of ferric chloride. M. W. CAREY and R. F. SCHOETZOW. *J. Am. Pharm. Assoc.* 16, 229(1927).—In soln. of FeCl_3 U. S. P. X nitrate is tested for by the ring test. In KI, nitrate is tested for by the $\text{Al} + \text{NaOH}$ test. A specimen of FeCl_3 soln. gave a positive ring test but a negative result by the $\text{Al} + \text{NaOH}$ test. Two solns. of FeCl_3 were prepd. without HNO_3 , the oxidation being induced by (1) H_2O_2 and heat and (2) gases from $\text{KClO}_3 + \text{HCl}$. Both solns. gave a positive ring test but a negative result with $\text{Al} + \text{NaOH}$. The ring test is, therefore, fallacious. L. E. WARREN

The occurrence and alkaloidal content of various Ephedra species. C. NIELSEN, H. McCausland and H. C. SPRUTH. *J. Am. Pharm. Assoc.* 16, 288-94(1927).—The species of *Ephedra* reported in the continental U. S., are *E. nevadensis*, *E. californica*, *E. viridis*, *E. trifurca*, *E. torreyana*, *E. antisiphilitica* and *E. pedunculata*. Specimens of a number of these were obtained. Some were identified and some were not. The roots, stems and green branches, when possible, were assayed separately for alkaloid, by the U. S. P. IX method for belladonna root. No alkaloids were found. In *Ma huang* the alkaloids are found in the green branches only. L. E. WARREN

Ephedrine, its isolation and detection from the toxicological standpoint. KUEN TSIANG and E. D. BROWN. *J. Am. Pharm. Assoc.* 16, 294-6(1927).—Cryst. ppts. are given slowly with Millon's reagent, AuCl_3 , PtCl_4 and Kraut's reagent. No color reaction is given with FeCl_3 . The alkaloid was mixed with ground meat and the Stas-Otto method applied. The alkaloid was recovered in pure form but quant. relations are not stated. L. E. WARREN

The standardization and stabilization of aconite preparations. III. E. E. SWANSON and C. C. HARGREAVES. *J. Am. Pharm. Assoc.* 16, 296-301(1927); cf. C. A. 18,

882; 19, 2862.—The p_H value controls the detn. and stabilization of aconite preps. It is recommended that tinctures and fluidexts. of aconite have a p_H value of between 2.5 and 3.00. The guinea-pig method and the white-mouse method agree remarkably well on standard aconite preps. but they do not agree when the deterioration factor is detd.

L. E. WARREN

The glucosides of *Caulophyllum thalictroides*. J. D. DAVY AND H. P. CHU. *J. Am. Pharm. Assoc.* 16, 302-5(1927).—Analysis of *Caulophyllum* by the method of Power and Salway (*C. A.* 7, 1706) yielded Me cystine and a non-cryst. glucoside which differed from that described by P. and S. A modification of the method gave a similar non-cryst., glucosidal product. By moistening the drug to allow enzyme action a cryst. and a non-cryst. glucoside were obtained. The glucoside in some respects resembles the caulosaponin of P. and S. but it is optically active. The caulophyllosaponin of P. and S. was not identified. The pharmacologic properties of the glucosides are being studied.

L. E. WARREN

The melting point of acetylsalicylic acid. T. S. CARSWELL. *J. Am. Pharm. Assoc.* 16, 306-9(1927).—The m. p. of finely powd. acetylsalicylic acid is 135° with variations of not over 0.2° . The m. p. of acetylsalicylic acid is dependent upon the size of the particles in the m.-p. tube, and to obtain uniform results grinding to a standard fineness must be adopted. The nearest approach to the true m. p. is given by the method of the new German Pharm., after grinding to 200 mesh. Variations in the m. p. after crystn. from different solvents are caused by differences in the phys. structure of the crystals, since grinding to a fine powder gives uniform m. p.

L. E. WARREN

Some interesting facts about mercurochrome. FITZGERALD DUNNING. *J. Am. Pharm. Assoc.* 16, 329-31(1927).—A short essay for the information of pharmacists.

L. E. WARREN

A pharmaceutical study of sirup of ferrous iodide (1840-1927). C. J. BRAFORD AND H. A. LANGENHAN. *J. Am. Pharm. Assoc.* 16, 336-9, 433-7, 561-7, 656-60(1927).—Historical review.

L. E. WARREN

A study of *Ephedra nevadensis*. R. E. TERRY. *J. Am. Pharm. Assoc.* 16, 397-407 (1927).—Three types of *Ephedra* are known, viz. the Asiatic, the European and the American group. The last includes 6 species, *Ephedra californica*, *E. nevadensis*, *E. trifurca*, *E. viridis*, *E. torreyana* and *E. antisiphilitica*. *E. nevadensis* is used in domestic medicine in Mexico. Plants were gathered in south central California. *E. californica*: H_2O 6.4-6.7%; ash 5.0-6.8%; acid-insol. ash 0.36-0.40%; ground drug: crude fiber 20.4-20.5%. *E. nevadensis*: macroscopical and microscopical characteristics are described. Unground drug: H_2O 5.1-5.6%; ash 6.8-7.4%; acid-insol. ash 0.25-0.31%. Ground drug: H_2O 8.0-8.3%; ash 6.4-14.6%; acid-insol. ash 0.3-0.7%. Whole drug: crude fiber 42.2-42.6%. Ground drug: 14.7%. Total Et_2O -sol. 6.3-8.1%; volatile H_2O ext. 0.6%; non-volatile Et_2O ext. 7.5%; resin 0.4%; $EtOH$ -sol. 17.6%; H_2O -sol. 8.3%. Alkaloids were absent. Tannin (gallotannic acid) was found in large amts. but quant. tests gave poor results. Traces of volatile oil were found. Infusions of the drug are slightly diuretic. The total absence of ephedrine is the most important fact discovered.

L. E. WARREN

Examination of *Asarum caudatum*. H. M. BURLAGE AND E. V. LYNN. *J. Am. Pharm. Assoc.* 16, 407-11(1927).—The rhizomes and roots contain from 2 to 4% of volatile oil, the yield depending on the time of collection. The contents of the oil of different seasons are tabulated. The oil contains azulene 10%, α -arone 10%, methyl-eugenol 60-75%, traces of pinene and probably other terpenes.

L. E. WARREN

A study of the stability of physostigmine solutions. J. C. KRANTZ, JR. AND F. J. SLAMA. *J. Am. Pharm. Assoc.* 16, 412-4(1927).—Solns. of physostigmine salts become red on long standing. The color is due to the formation of eseroline. The salicylate is more stable than the sulfate. The salt is stable in a satd. soln. of salicylic acid (p_H 2.45) or in H_2SO_4 of p_H 3.7; CO_2 in the soln. or in the atm. above the soln. does not stabilize for long, but a combination of the 2 stabilizes for long periods. N is not so effective.

L. E. WARREN

A modified Calvert test for diethyl phthalate. R. D. SCOTT AND E. G. WILL. *J. Am. Pharm. Assoc.* 16, 417-9(1927).—In the original Calvert test (*C. A.* 17, 1202) 5-10 drops of $PhOH$ is added to 3-5 cc. of sample, 10 drops of H_2SO_4 is added and the mixt. heated with a Bunsen burner. S. and W. find that the heat of a boiling water bath is sufficient for the reaction if allowed to proceed overnight. The amt. of H_2SO_4 may be materially reduced, thus allowing a reduction of the alkali required. The sensitivity of the test is increased by increasing the amt. of $PhOH$. For convenience the $PhOH$, H_2SO_4 and $EtOH$ may be added together. The sensitivity is increased by

carefully adjusting the amt. of alkali added at the end, the optimum pH being between 11 and 12. L. E. WARREN

Some applications of colloidal chemistry to pharmacy. PELL BROADY AND C. B. JORDAN. *J. Am. Pharm. Assoc.* 16, 425-30(1927).—Many expts. were conducted in the effort to apply the principles of colloidal chemistry to practical pharmacy. A formula for prepg. *Hg ointment* was developed. Dissolve 2.5 g. of gelatin and 40 g. of NaOH in 200 cc. of H_2O with heat. Cool and add 20 g. of 37% HCHO. Dissolve 40 g. of $HgCl_2$ in 200 cc. of H_2O with heat. Add the hot soln. slowly to the alk. gelatin mixt. with stirring. Wash the ppt. twice by decantation with 200 cc. of H_2O . Filter, transfer the moist ppt. to a mortar, add 25 g. of anhyd. lanolin and mix. Add white petrolatum to 100 g. The advantages claimed over the usual ointment are: (1) the ointment is more readily prepd. and (2) in less time and (3) the Hg is in finer suspension. *Prepn. of Ag ointment*.—Dissolve 4 g. of dextrin and 4 g. of NaOH in 100 cc. of H_2O ; dissolve 3 g. of $AgNO_3$ in 20 cc. of H_2O and pour the latter soln. into the former with stirring. The ppt. of Ag_2O gradually changes to Ag. This is pptd. by EtOH and the ppt. washed with EtOH. The moist ppt. is mixed with anhyd. lanolin. A stable, colloidal AgCl was prepd. by treating a soln. of $AgNO_3$ in gelatin with dichloramine-T. The AgCl was collected on a filter. The suspension of AgCl was stable for several days in sunlight. Colloidal AgCl was prepd. by adding a soln. of $HgNO_3$ to a soln. of NaCl and gelatin. The suspension was stable. L. E. WARREN

Physiological potency of imported ergot of rye. GEORGIANA S. GITTINGER AND J. C. MUNCH. *J. Am. Pharm. Assoc.* 16, 504-5(1927).—Samples from 69 shipments from various foreign countries were assayed by the official cockscomb method. Of these 42 or 60% were stronger than the U. S. P. standard. Five contained mites but they were as active (or were more potent) as the standard. Three of 5 Polish samples were substandard. Seven of 9 Russian samples were below U. S. P. requirements. Of 27 Spanish samples 26 were of full strength. Of 22 consignments from miscellaneous ports 16 were below standard. L. E. WARREN

The assay of ergot by the cockscomb method. GEORGIANA S. GITTINGER AND J. C. MUNCH. *J. Am. Pharm. Assoc.* 16, 505-10(1927).—Ergot preps. should be converted into fluidexs. for assay. Single-comb White Leghorn cocks have been found the most satisfactory breed of bird for assay purposes. Variations in sensitivity to ergot are found in birds used for assay. Therefore, all birds should be standardized before being used for the assay of unknown samples. Durations of the effect of injection of the drug should be noted. Expts. under way suggest the possibility that the prescribed rest period may be safely reduced to one week. A sufficient no. of assays should be made on any unknown sample definitely to det. its potency. L. E. WARREN

The colorimetric assay of digitalis. L. W. ROWE. *J. Am. Pharm. Assoc.* 16, 510-6(1927).—The Knudson and Dresbach picric-acid colorimetric method for the assay of digitalis (*C. A.* 16, 3711) was compared with the M. L. D. frog-heart method of Houghton. In 6 tinctures the colorimetric method gave results 40-50% too high. The artificial color standard (0.344 g. $K_2Cr_2O_7$ per l.) suggested by Knudson was tried thoroughly and discarded because the artificial color was not the same as that developed in the purified digitalis solns. In a second series of 23 various preps. of digitalis the colorimetric values were from 77 to 42% high as compared with the frog method. In a third series the technic was standardized by always making the comparative readings of the standard and sample 20 min. after the color of the final mixt. had started to develop. In 19 samples the colorimetric method gave results 16% low to 50% high. Digitalin is not a satisfactory standard. In a fourth series of preps. the color tests averaged 32% high. With ouabain as a standard the extremes were too far apart. German digitalin and digitoxin were used as standards but were abandoned because the colors produced by different lots did not correspond to the activity by the frog method. The color test for digitalis is not satisfactory as a means of detg. therapeutic value. L. E. WARREN

The possible influence of ether anesthesia on the accuracy of the cat method of digitalis assay. H. B. HAAG. *J. Am. Pharm. Assoc.* 16, 516-8(1927).—The light ether anesthesia necessitated in the Hatcher-Brody cat method of digitalis assay does not materially influence the resulting minimal lethal dose. L. E. WARREN

The theory and art of pharmacopeia revision, in the interest of pharmaceutical service. H. H. RUSBY. *J. Am. Pharm. Assoc.* 16, 528-34(1927).—Ten fundamental principles on which pharmacopeia revision is based are outlined. Examples are cited which indicate that most of the enumerated principles are violated in the revision which resulted in the U. S. P. X. L. E. WARREN

Incompatibilities of prescriptions containing epinephrine hydrochloride. M. J.

ANDREWS. *J. Am. Pharm. Assoc.* 16, 555-6(1927).—Four prescriptions calling for epinephrine-HCl are given and their incompatibilities discussed. Two were rendered alk. by the presence of borax; 1 contained AgNO_3 and another mineral oil. L. E. W.

Flavoring qualities of vanilla tinctures. H. M. TAYLOR AND R. A. KONNERTH. *J. Am. Pharm. Assoc.* 16, 556-61(1927).—Mexican beans give the best flavor, Bourbon being second and Tahiti third. Tahiti beans should never be used except in the cheapest exts. The circulatory displacement method gives the best results. At least 3 months should be allowed for the extn. Aging is necessary and the process should continue for at least a yr. A single type of vanilla tincture will not flavor all preps. with a max. strength and fragrance of flavor. For preps. to which heat is to be applied, such as puddings, cakes, candy, etc., a tincture made from pure Bourbon bean is best; for preps. not subjected to heat a mixt. of 40% Mexican beans and 60% Bourbon beans gives a tincture having the most desirable properties. A comprehensive bibliography is appended. L. E. WARREN

The earthworm method for testing santonin and related anthelmintics. ALBERT SCHNEIDER. *J. Am. Pharm. Assoc.* 16, 623-7(1927).—An outline of a proposed method. No exptl. results are recorded. L. E. WARREN

Some colloidal chemical aspects of pharmacognosy. ANTON HOGSTAD. *J. Am. Pharm. Assoc.* 16, 627-32(1927).—An address. L. E. WARREN

New methods for the determination of cinchophen and the choice of indicators for its titration. S. PALKIN. *J. Am. Pharm. Assoc.* 16, 632-5(1927).—Previously described methods have depended on the extn. of cinchophen from the other ingredients by a solvent and titration of the acidity of the ext. P. observes that cinchophen may be completely extd. from an acidified soln. by means of Et_2O or CHCl_3 . (A mixt. of equal vols. of the 2 solvents is recommended.) About 8 shake-outs are necessary. The solvent is washed twice with H_2O , the soln. evapd. and the residue weighed. In a second method the alk. soln. of cinchophen is acidified with an excess of dil. H_2SO_4 , a soln. of KBrO_3 .KBr added and the resulting Br compd. removed by shaking with successive portions of Et_2O . The solvent is washed and evapd. to remove excess Br with precaution to avoid decrepitation. Before dryness is attained acetone is added and the evapn. continued. Several treatments with acetone usually give a residue of const. wt. Electrometric titration indicates that phenol red, bromothymol blue and cresol red are suitable indicators for titration of cinchophen in H_2O soln. L. E. W.

Interpretation of biologic assays. PAUL S. PITTENGER. *J. Am. Pharm. Assoc.* 16, 714-7(1927).—An essay. L. E. WARREN

Determination of total citric acid in solution of magnesium citrate. J. L. MAYER. *J. Am. Pharm. Assoc.* 16, 719-22(1927).—The U. S. P. X. method is unsatisfactory. A method is suggested which gives results more rapidly and which are as accurate. Into a Pt or porcelain evapg. dish measure 10 cc. of a soln. of Mg citrate, freed from CO by pouring from one container to another, add 10 cc. H_2O , evap. until the vol. is 10 cc., titrate the acidity with 0.5 N NaOH using phenolphthalein. Evap. the neutralized liquid to dryness and ignite; cool, moisten with H_2O and evap.; ignite, repeating the process until a white ash is obtained. Add 30 cc. of 0.5 N H_2SO_4 and heat on a steam bath for 5 min.; cool and titrate with 0.5 N NaOH using methyl orange. L. E. WARREN

The need of greater activity in the making of analyses of medicinal preparations found in the open market and of a wider publicity of the analyses. F. J. WULLING. *J. Am. Pharm. Assoc.* 16, 722-4(1927).—Comment on a report by Prof. G. Bachman of the Minn. Pharm. Assoc., on drug adulteration. L. E. WARREN

The quality of drug products. R. L. SWAIN. *J. Am. Pharm. Assoc.* 16, 724-6(1927).—A study of 1300 drug products collected in Md. over a period of 2 yrs. Of the total no. 153 or 12% were below standard. S. considers this to be a good showing for pharmacy. L. E. WARREN

Theoretical structure of the correction factor as applied in the menthol assay of peppermint oil—with a note on the assay of oil of rosemary. SIMON MENDELSON. *J. Am. Pharm. Assoc.* 16, 726-29(1927).—M. believes that the correction factor prescribed for the oils of peppermint and rosemary by the U. S. P. X. might be obviated by using the method of assay recommended by Parry (Com. Org. Analysis, Allen, ed. 5, vol. 4, 596). M. quotes the method but gives no analytical results. L. E. WARREN

The work, principal purposes and ideals of the American Pharmaceutical Association. J. H. BEAL. *J. Am. Pharm. Assoc.* 16, 799-809(1927).—An address. The details of the achievements of the Am. Pharm. Assoc. during the nearly 76 yrs. of its existence are recorded in 59 vols. of Proceedings, 13 vols. of the Year Book, 6 vols.

of the Bulletin and 16 vols. of the Journal, making 94 vols. in all, comprising a total of more than 76,000 printed pages, without including the 5 separately published revisions of the National Formulary. L. E. WARREN

Monardella oil. E. R. MILLER. *J. Am. Pharm. Assoc.* **16**, 828(1927).—A species of *Monardella*, probably *M. lanceolata*, grows abundantly in the Yosemite and Lake Tahoe regions of California. The odor of the plant suggested pulegone. The yield of oil from air-dried plant was 1% d_{16}^{20} 0.9392; n_D^{20} 1.4908; $[\alpha]_D^{20}$ +17.4°. Pulegone was identified and appeared to be the chief constituent of the oil. L. E. WARREN

Reaction of anesthetic ethers with potassium hydroxide and with mercury and the test for foreign odors. EDWARD MALLINCKRODT, JR. *J. Am. Chem. Soc.* **49**, 2655-66(1927).—Under av. conditions, if Et_2O contains less than about 0.05% of aldehyde it will probably not be detected by the official aldehyde test in U. S. P. X., whereas the test employing solid KOH will, with the precautions given in this paper, detect 0.01%. Peroxides and alc., if present, produce characteristic appearances in this test; their effects are described. Shaking with metallic Hg provides a convenient means of decomp. the org. peroxides naturally occurring in old Et_2O with liberation of ACH in accordance with the work of Clover and Winkler on the constitution of these peroxides. The presence of more than minute traces of peroxides in Et_2O can be detected by a characteristic odor when the Et_2O is evapd. to small vol. and smelled after pouring upon paper. C. J. WEST

Dry yeast fermentation (SABALITSCHKA, WEIDLICH) **16**. Some observations on digitalis action (SCHNEIDER) **11H**. Standardization of digitalis (MARTIN) **11H**.

Arsenical medicinal composition. I. OSTROMUISLENSKII. U. S. 1,644,348, Oct. 4. Arsphenamine or other arsenical compns. of relatively high toxicity are used with gum arabic, which reduces their toxicity, to permit intravenous injection, and with glucose, which renders the compd. isotonic with respect to the blood.

Ergot preparation. GUSTAV ERDMANN. U. S. 1,645,096, Oct. 11. The oily residue from an ether ext. of ergot after evapn. of the solvent is treated with naphtha or similar reagent and the ppt. is sepd., washed and dried, dissolved with 10% HOAc, purified by shaking with ether repeatedly, alkaloids are pptd. from the soln. with NH_3 and tartrate salts are formed from the sepd. and dried ppt. Some other modifications of the procedure are also described as optional.

Anesthetic. O. BILLETER, E. ROTHLIN and J. PEYER. Can. 274,214. Sept. 27, 1927. Anesthetics are prepd. by causing suitable salts of $m\text{-H}_2\text{NC}_6\text{H}_4\text{CO}_2\text{H}$ esters to react by double decompn. with suitable salts of alkylsulfonic acids.

Gaseous mixture containing helium (for respiration). W. P. YANT, R. R. SAYERS and J. H. HILDEBRAND. U. S. 1,644,363, Oct. 4. Persons under compression are supplied a mixt. for respiration consisting mainly of O and N (with a lower % of O than in air), and while under decompression, with a gas comprising mainly O and He.

Salts of quinine combined with acetylaminohydroxyphenylarsonic acid. F. BILLON. U. S. 1,643,692, Sept. 27. Alkaloids such as quinine are combined with acetylaminohydroxyphenylarsonic acid directly or by reaction of salts of the components. The products are therapeutic agents of but slight toxicity.

Heterocyclic compound. A. BINZ and C. RATH. Can. 274,750. Oct. 18, 1927. Heterocyclic compds., contg. N_2 as a hetero-constituent and being free from active carbonyl groups, are diazotized and the products caused to react with substances of the general formula $\text{R}(\text{OR})_3$, in which R represents a therapeutically valuable element like As and Sb and R_1 represents an electropositive element which may be H_2 .

Decreasing the toxicity of cocaine. R. ECKERMANN. Swed. 61,992, Nov. 23, 1926. A salt or a deriv. of cocaine is treated with an org. acid or base, or an alc., or a phenol or a mixt. of these, with or without heat, and there is added urethan or a salt or deriv. of urethan which has also been treated with an org. acid or base, an alc., a phenol or a mixt. of these. Together with several by-products a cocaine prepn. is then obtained which has a reduced toxicity and an increased local-anesthetic power.

Concentrating deposits of radioactive emanations or similar active material. H. B. PALMER. U. S. 1,644,350, Oct. 4. A plurality of carrying bodies such as pills are introduced into a vessel which is also supplied with emanations from radioactive material and these bodies are subjected to a negative elec. potential, shielded against active deposit and then successively unshielded for subjection to the emanation to adapt them for internal medication. An app. is described.

Bile acid derivative. A. GAMS and P. SCHNEIDGGER. Can. 274,267. Sept. 27,

1927. Compd. of therapeutic substances are manufd. by causing an asymmetrically acylated aliphatic diamine to react with a bile acid in presence of a solvent.

Dentifrice. W. BRUCK. U. S. 1,643,618, Sept. 27. Soap and mild abrasive materials such as talc. are used with alkali salts of phenolsulfonic acids such as Na *p*-phenolsulfonate and other ingredients, *e. g.*, glycerol, tincture of benzoin and alc.

18—ACIDS, ALKALIES, SALTS AND SUNDRIES

FRED C. ZEISBERG

Concentration of sulfuric and nitric acids, Strzoda system. W. STRZODA. *Chem.-Ztg.* 51, 525-6 (1927).—To concentrate the H_2SO_4 it is passed through 8 externally heated "Acidur" tubes in series; the vapors are sepd. into 60° Bé. acid and steam in a filled tower, the acid running back into the concn. system, the steam condensing in a cooling tower. The capacity is around 0.8 ton of 97 to 98% H_2SO_4 per tube. A HNO_3 concn. system is similarly constructed, strong H_2SO_4 being added to the dil. HNO_3 for dehydration; the H_2SO_4 is regenerated in a second system coupled to the first by an acid-scaled connection.

B. J. C. VAN DER HOEVEN

The volumetric relations in the conversion of hydrogen sulfide to sulfurous acid. R. NITZSCHMANN AND E. VOGEL. *Chem.-Ztg.* 51, 557-8 (1927).—Formulas and graphs are given for the calcn. of the usual quantities involved in the oxidation of H_2S .

J. H. P.

Ammonia as a source of nitrogen oxides for chamber acid plants. D. H. KILLER. *Ind. Eng. Chem.* 19, 1153-6 (1927).—The substitution of NH_3 -oxidation units for the common niter pots in Pb -chamber H_2SO_4 plants effects decided savings in the cost of raw materials, labor and upkeep. One 75-ton plant using the new system has obtained a reduction of more than 2% in the cost of the finished acid. A complete description of the NH_3 -oxidation process is given for the use of both anhydrous NH_3 and NH_4OH .

J. H. PERRY

A new method for the evaporation of electrolytic caustic. W. L. BADGER. *Trans. Am. Inst. Chem. Eng.* 18, 231-48 (1927).—An evaporator of the vertical tube type was designed with forced circulation by an external pump. The velocities were 5-10 ft. per sec. at the bottom of the tubes. The result was a very high coeff. of heat transfer, and the heating surface for a commercial machine became so small that it could be made of Ni tubes. No trouble was experienced from salting. The coeffs. were so high that small working temp. drops could be used, and this made possible concn. from cell liquor to 40% $NaOH$ in triple effect with steam at 25 lbs. gage. A diagram giving the boiling points of $NaOH$ solns. at diff. pressures is given, but it is in error at high concns. In the discussion, *caustic embrittlement of steel* is covered at length.

W. L. BADGER

The influence of methane on the synthesis of ammonia. R. SCHÖNFELDER. *Ber. Ges. Kohlen-techn.* (Dortmund-Eving) 1925, 514-39; *Chem. Zentr.* 1926, II, 2470.—The point is calcd. at which the slightest increase in the CH_4 content or decrease in the H through NH_3 formation causes deposition of C. At 700° and 1 atm. total pressure a CH_4 content of 6.7% is admissible and at 700° and 100 atm. pressure, 70%. Under ordinary operating conditions there is accordingly no danger of CH_4 decompn. The diluent effect of CH_4 is more objectionable as shown by tabulated data obtained with the aid of the Tour curves (cf. *C. A.* 15, 1967). With 50% CH_4 the yield of NH_3 drops almost to 0.25 of that obtained with pure N and H . $Ca_3Fe(CN)_6$ dehydrated and decompd. in a current of air at 800° served as catalyst (cf. *German Patents* 285,698 and 286,719). The app. is described. At ordinary pressures thoroughly dried and purified gases give the best yield at 475° and a "space velocity" of 2000. CO_2 and H_2O behave as poisons, no NH_3 being formed in their presence at the temp. most favorable for its formation with N and H when pure or contg. CH_4 . Toward 600-690° the poisonous action disappears, though the equil. is still unfavorable. If because of increased temp. with 36% CH_4 there is deposition of C, this does not exert any poisonous action. With subsequent replacement of the mixt. contg. CH_4 by a new gas mixt., a far more favorable yield is obtained. The "space velocity," which at first had been reduced to about 0.5 its value because of obstruction of the pores, increases after partial removal of the C as CH_4 to 80% of its original value. The yield from pure gases, which is 62% at 500°, increases to 88%. At a working pressure of 100 atm. and a "space velocity" of 8600, the optimum temp. was found to be 590°. The dependence of the quantity of NH_3 on the CH_4 content is shown graphically. When with CH_4 -free gas the "space-time yield," is 0.132; the latter decreases to 0.048 when 51% CH_4 is present. In an expt. of 102 hrs., CH_4 had

no slow poisonous action. After 30 hrs. the "efficiency," i. e., the NH_4 content obtained expressed as % of that present in the equil., increased, confirming the results of Firmin (C. A. 16, 2200; *Industrie Chimique* 9, 339, 436). With increasing "space velocity," the NH_4 content and the "efficiency" diminish, while the space-time yield increases. Surprising and also of importance for the use of coke-oven gas is a decrease of the "efficiency" with increase in the N content. At 100 atm. pressure, 590° , 30% CH_4 and a N/H ratio of $1/38$ it is 80, while with N/H 1/14 it is only 52. Detailed tabular data show, however, that even 8 contact ovens joined in series have less than 0.5 the capacity required for a mixt. of 30.2% CH_4 , 52.5% H and 17.3% N at 300 atm. pressure, 600° and a "space velocity" of 8000. Claude, however, with CH_4 -free chilled gas at 900 atm. pressure and a "space velocity" 10 times as great attains 20 times as great a yield, so that the relatively troublesome cooling is justified.

C. C. DAVIS

Production of synthetic ammonia at the works of the Badische Anilin and Soda Fabrik at Oppau. H. W. STRONG. *Ind. Chemist* 3, 403-5(1927).—A short account, illustrated, is given of the manuf. of NH_3 and $(\text{NH}_4)_2\text{SO}_4$ from producer gas.

E. G. R. ARDAGH

Rapid catalytic processes in flowing gases and ammonia oxidation. V. LEONID ANDRUSSOV. *Ber.* 60B, 2005-18(1927); cf. C. A. 21, 1872.—Formulas are derived mathematically for calcg. the NH_3 concn. gradient along a heated Pt capillary tube when a mixt. of NH_3 and O is passed through the tube. It is postulated that oxidation to NO takes place only at the catalyst surface, and that reaction to yield N takes place only in the free gas space. The effect of gas flow and initial gas compn. on the reaction in heated Pt capillaries was measured. The results are compared with those calcd. by the above formulas.

R. L. DODGE

The production of ammonium sulfate and sulfur from ammonium thiosulfate. W. GLUUD AND R. SCHÖNFELDER. *Ber. Ges. Kohlentechn.* (Dortmund-Eyving) 2, 23-5; *Chem. Zentr.* 1926, II, 2470-1.—The process, which is patented (*German Patent* 415,587), is based on the reaction: $3(\text{NH}_4)_2\text{S}_2\text{O}_3 + \text{H}_2\text{SO}_4 \longrightarrow 3(\text{NH}_4)_2\text{SO}_4 + 4\text{S} + \text{H}_2\text{O}$. The reaction is carried out at 90° and proceeds at first rapidly but then comes to a stop when about 98% of the $(\text{NH}_4)_2\text{S}_2\text{O}_3$ is converted. The course of the reaction, which was followed by analysis with I periodically, is shown graphically. In 50% soln the undecompd. residue is 0.3%, in 5% soln. it is 4% of the $(\text{NH}_4)_2\text{S}_2\text{O}_3$. Only with 100% excess of H_2SO_4 is SO_2 evolved. The S which seps. is readily filtered or centrifuged and with pure reagents is obtained in pure form.

C. C. DAVIS

Production of soda products from sodium sulfate. P. A. CHEKIN. *J. Chem. Ind.* (Russia) 2, 664-5; *Chem. Zentr.* 1926, II, 1169-70.—Soda can be prepd. from Na_2SO_4 by the Leblanc or the Penjakow process. The latter process is based on the reactions $4\text{Al}_2\text{O}_3 + 4\text{Na}_2\text{SO}_4 + 2\text{C} \longrightarrow 8\text{NaAlO}_2 + 4\text{SO}_2 + 2\text{CO}_2$, and $2\text{NaAlO}_2 + \text{CO}_2 \longrightarrow \text{Al}_2\text{O}_3 + \text{Na}_2\text{CO}_3$. The first reaction proceeds at a bright red heat, the second reaction in water at room temp. Though the Penjakow process has advantages over the Leblanc process, it cannot compete with the Solvay process. It can, however, be utilized for the manuf. of NaOH. The NaAlO_2 is dissolved in water and agitated with freshly pptd. $\text{Al}(\text{OH})_3$. After 24-36 hrs. about 80% of the Al settles out as $\text{Al}(\text{OH})_3$ in a form which is readily sepd. The remainder of the Al is pptd. according to the reaction: $2\text{NaAlO}_2 + \text{Ca}(\text{OH})_2 \longrightarrow 2\text{NaOH} + \text{Ca}(\text{AlO}_2)_2$. The alkali liquor is concd. in the usual way and worked up, the ppt. is decompd. by boiling Na_2CO_3 soln. under pressure, the NaAlO_2 which is formed in soln. is decompd. by CO_2 and the $\text{Al}(\text{OH})_3$ returned to the process.

C. C. DAVIS

Transformation of sodium chromate into dichromate by means of carbonic acid. YA. R. GOLDSTEIN. *J. Chem. Ind.* (Russia) 1926, 564-6.—The exptl. results obtained by Yushkevich and Levin (C. A. 21, 3713) are incomplete and partly incorrectly explained. The fundamental condition of max. yield is the max. concn. of Na ion (whether in the form of chromate or dichromate) and the max. concn. of H ion of carbonic acid; the temp. has but an unimportant role.

BERNARD NELSON

Industrial sodamide. A. GUNTZ AND F. BENOIT. *Bull. soc. chim.* 41, 434-8 (1927).—Two samples of com. NaNH_2 gave the following analyses: NaNH_2 94.50, 80.50; NaH 1.85, 11.75; NaOH 3.25, 6.30; Fe 0.16, 1.60%. The presence of NaH accounts for variable results obtained in org. reactions when impure NaNH_2 is used and also presents a danger in the liberation of H when treated with H_2O in some reactions.

R. C. ROBERTS

Marine waters and the problem of potassium. III. Preliminary technological inquiries relative to the application of the Nicolli process. ENRICO NICOLI. *Giorn. chim. ind. applicata* 8, 603-10(1926); cf. C. A. 21, 2880.—As a source of the raw material for the process, true marine waters were found preferable to the brines of Mollake.

The curves of concn. of the given brines were detd. from the beginning of evapn. up to 38° Bé., with relation to vol. and av. evapg. velocity at the local temps. The mode of freeing from salts the impermeable argillaceous soils destined to form the evapg. basins for the pure solns. was studied. The source of supply for the industrial waters required in the process was found in an artesian well sunk to a depth of 232 m. R. S. P.

Preparation of alkali silicates from the chlorides. *L. HACKSPILL AND J. SALOMON. *Chimie et industrie Special No.*, 435-7 (May, 1927).—The reaction $\text{SiO}_2 + 2\text{NaCl} + \text{H}_2\text{O} \rightleftharpoons \text{Na}_2\text{SiO}_3 + 2\text{HCl} - 100 \text{ cal.}$ goes towards the right at high temps. (1000–1500°); but the rate of reaction is very slow at atm. pressure (on heating 5–6 g. of lump quartzite at 1000° in an atm. of NaCl and H₂O, 0.4% was transformed in 30 min.). Under reduced pressure the rate is greatly increased (reducing the pressure to 50–60 mm. in the above expt. resulted in a transformation of about 6% of the SiO₂). The use of finely divided SiO₂ (calcined gelatinous SiO₂) resulted in practically quant. conversion of the SiO₂ at a rate too rapid to be measured. The app. used for the lab. expts. is described, and the lines along which it would have to be modified to industrialize the process are discussed. A. PAPINEAU-COUTURE

The production of potassium salts from the rape of Crimea. S. I. VOLFKOVICH. *J. Chem. Ind. (Russia)* 1, No. 2, 27–32 (1925); *Chem. Zentr.* 1926, II, 810.—A survey of the present state of the trade and its possibilities. The production actually reaches several tons of KCl (raw product) yearly. A. L. HENNE

The exploitation of the magnesium lakes of the Crimean peninsula. S. F. ZHEMCHUZHNIU. *Ann. inst. anal. phys. chim.* 3, 370–8 (1926).—The water of lakes Staroe and Krasnoe contains 14–25% MgCl₂; of Kiyatskoe 10–18%; of Krugloe and Aigulskoe, 10–14%. The total MgCl₂ reserve is at least 1.5 million tons. It can be utilized in the manuf. of cement grindstones, etc. since sand and hard minerals are locally available. BASIL C. SOYENKOFF

Glauber's salt from Karabugas and its dehydration. A. I. KITAIGORODSKII. *J. Chem. Ind. (Russia)* 2, 666–8; *Chem. Zentr.* 1926, II, 1169.—In the winter months Glauber's salt appears in vast quantity on the shores of Karabugas (gulf of the Caspian sea). It contains no trace of Fe and only 0.03% MgSO₄ and CaSO₄. Though contg. normally 54.42% water, the temp. in the summer months frequently exceeds 32°, which is the temp. of conversion to the anhyd. salt so that in summer-time practically unlimited quantities of dry Na₂SO₄ can be obtained, without resort to artificial drying. C. C. D.

The composition of technical calcium hypochlorites and their behavior on heating compared with chloride of lime. HUGO DITZ AND RUDOLF MAY. *Z. Elektrochem. angew. physik. Chem.* 33, 265–72 (1927).—Ca hypochlorite (Griesheim) is analyzed by known methods, 78.88% active Cl being detd. These values are compared with the analytical values of Kast and Merz (*C. A.* 21, 1872) and Hofmann and Ritter (*C. A.* 8, 3275) for other hypochlorites. The active Cl in K. and M.'s detn. is about 10% lower than the others, owing, probably to incorrect methods. Values of K. and M. for the 60, 110 and 110/115 grades of chloride of lime show that they contain less than half the active Cl of hypochlorite. Ca hypochlorite is heated at 90°, 170–80° and red heat in a CO₂- and H₂O-free atm. The splitting off of Cl, with increase in temp., is not much greater, while the active Cl in the remainder is reduced from 78% at 90° to less than 1% at 170°. Expts. with hypochlorite contg. an equiv. amt. of CaCl₂ show that while at 90° the active Cl is 48%, at 150–60° it is reduced to 0.35% and a trace at red heat; the Cl given off increases from 1.5% to 5–6%. With decrease of CaCl₂ in hypochlorite there is a decrease in the Cl liberated, CaO having no effect. K. and M.'s results on the action of heat on chloride of lime, of H₂O at various temps. below 100° and the influence of CO₂ are given and compared with those of H. and R. J. BALOZIAN

Preparation and mechanical treatment of phosphates. I. M. VERKHOVSKII. *Trans. Inst. Fertilizers* 22, 3–80 (1924).—V. presents data showing that by roasting phosphate ore low in P₂O₅, then crushing the material and carrying it over picking belts which sep. the various sized pieces, screening and grinding in mills with air separations, a phosphate may be obtained which should run as high as 28% P₂O₅. An English résumé is given. J. S. JOFFE

Dehydration of metallic salt hydrates. I. Dehydration of sodium borate, carbonate and sulfate. M. A. RAKUZIN AND D. A. BRODSKI. *Z. angew. Chem.* 39, 1345–8 (1926); cf. *C. A.* 21, 3321.—Cold 95% alc. dehydrates completely the decahydrate of Na sulfate, has no effect on borax crystals, and removes about 75% of the water from Na carbonate decahydrate. Na sulfate is also completely dehydrated in 48 hrs. by 80% alc., and in 9 hrs. in a current of dry air at the ordinary temp. Na carbonate decahydrate is more slowly converted into the monohydrate in dry air at 15°, and on exposure to the atm. this compd. is converted into the stable dihydrate,

which is also the final product obtained by prolonged exposures of the decahydrate to the atm. Borax remains completely unchanged on exposure to damp or dry air for prolonged periods. The reason for the different behaviors of the 3 decahydrates is to be found in their heats of formation from the anhyd. salt; there are 36.0, 21.8 and 18.82 g.-cal. resp., for the borate, carbonate and sulfate. B. C. A.

The working up of thiocyanate liquors into carbon disulfide and ammonia. W. GLIUD AND W. KLEMP. *Ber. Ges. Kohlentechn.* 2, 54-8; *Chem. Zentr.* 1926, II, 2497.--To the paper by G., Keller and Klempt on the utilization of NH_4SCN (C. A. 20, 3687) should be added that PbS can be converted again into $\text{Pb}(\text{SCN})_2$ by treating with HSCN . It is considered possible at a suitable temp. to conduct a continuous stream of CS_2 and $\text{H}_2\text{S} + \text{HSCN}$ simultaneously over $\text{PbS} + \text{Pb}(\text{SCN})_2$. C. C. D.

The fixation of air nitrogen. ERICH KONTIG. *Teer* 25, 327-32(1927). -A general review covering the Frank-Caro, Haber-Bosch, Claude, Casale, Mont Cenis, Birkeland-Eyde, cyanide and nitride processes. F. S. GRANGER

A laboratory study of nitrogen fixation by the high-tension arc. P. G. COLIN AND HERMAN V. TARTAR. *J. Phys. Chem.* 31, 1539-58(1927); cf. C. A. 20, 2393.--The effect of reduced pressure on the yield of fixed N from an elec. arc was measured. The expts. were so conducted that the gas passed through the arc at const. velocity. There was a gradual decrease in concn. of NO and in the yield per kw-hr as the pressure was reduced. The pressure range covered was 200 to 700 mm Hg. The pressure at which a max. concn. of NO was obtained depended upon the current through the arc. The max. concns. of 8.8% NO for air, 12.2% for mixts. of 4 parts O and 1 part N, and 13.1% for mixts. of equal parts of O and N, were obtained at a pressure of about 100 mm. Hg. The law of mass action holds approx. for the reaction between O and N in the elec. arc at pressures greater than $\frac{1}{2}$ atm. It is probable that at lower pressures the thermal effects no longer predominate in the arc, but elec. effects give rise to deviations from the mass-action law. The concn. of NO cannot be increased by bringing the gases leaving the arc into contact with H_2O -cooled walls. R. L. DODGE

The fixation of atmospheric nitrogen as cyanide. BRUNO WAESER. *Metallbörse* 16, 2073-4; *Chem. Zentr.* 1926, II, 2836-7; cf. C. A. 21, 1872.--The formation of cyanide from coal satd. with alkali and N at high temps., which has long been known, has recently been applied with success in several places (Holland, England, U. S. A.) to the technical prepn. of alkali cyanides. All processes depend upon the conversion of alkali carbonate with coal in a current of N at 900-1000° in the presence of Fe as catalyst, alkali cyanide and CO being formed. The cyanide is purified by fusion, by lixiviation or by distn. from the final reaction product. Na_2CO_3 , K_2CO_3 or mixts. of the two can be used. The form of the alkali-coal mixt. (whether powder, briquets or otherwise), the fineness of the state of subdivision of the Fe and the velocity of the N current all have a determinative influence on the course of the reaction. Under favorable conditions, 100% conversion can be obtained in 30-60 min. BaCO_3 can be used in place of alkali carbonates, in which case it is highly compressed with coal and heated 15 min. at 1400°, which yields about 60% of cyanide. The cyanide is worked up into "pure cyanide" or is used for combating plant vermin. Cyanide is also used for the production of NH_3 , in which case it is treated with boiling water under pressure, NH_3 , Na_2CO_3 , H and CO being recovered in the final product. By combustion of H and CO with air, the N which is necessary in the cyanide process is readily obtained in a pure state. From a technical and an economic standpoint, however, it is disadvantageous for the Na_2CO_3 to be recovered in dil. soln. In this respect the use of BaCO_3 is preferable. It has also been shown by Hara and Miura (C. A. 19, 2112) that, when mixed with Na_2SO_4 or NaCl and Fe, BaCO_3 gives a good yield of NaCN in a short time at 1000°. By working up the BaSO_4 -NaCN or BaCl_2 -NaCN liquor from this process into NH_3 valuable by-products such as *blanc fixe* and NH_4Cl are also recovered. The production of NH_3 by the cyanide process is therefore worthy of consideration. C. C. D.

Absorption of nitrogen oxides in an aqueous suspension of phosphate rock. V. N. MORRIS. *Ind. Eng. Chem.* 19, 1143-7(1927).--The absorption of N oxides in concns. of 10-16% by wt. in suspensions of Florida phosphate rock in H_2O and various HNO_3 solns. has been studied. The oxides are converted for the most part into $\text{Ca}(\text{NO}_3)_2$ and the phosphate rock is converted into the H_2O -sol. form. The addn. of phosphate rock to the absorbing solns., particularly in those cases where a considerable concn. of HNO_3 has been formed, increased the degree of absorption of the oxides, unless too great a quantity of the rock has been added. The substitution of $\text{Ca}(\text{NO}_3)_2$ or $\text{Ca}(\text{H}_2\text{PO}_4)_2$ for an equiv. amt. of HNO_3 in the absorbing soln. causes an increase in the degree of absorption. Solns. of these salts are better absorbing media than H_2O alone up to certain concns. From a study of the solvent action on the phosphate rock it is indicated that

the first HNO_3 formed attacks some other Ca compd. more readily than it does the tricalcium compd.

J. H. PERRY

Advances in the inorganic heavy chemical industry in the years 1924-1926. II. BRUNO WARSER. *Fortschrittsber. Chem.-Ztg.* 1927, 84-100; cf. *C. A.* 21, 2762. E. J. C.

Manufacture of bromine from iron bromide. P. HÖFER. *Kali* 21, 222-4(1927).—Technical iron bromide, $\text{FeBr}_2 \cdot 2\text{FeBr}_3$, is oxidized to free Br and Fe_2O_3 when heated to $310-70^\circ$ in a current of air. The process proceeds in 2 phases, viz., the oxidation of FeBr_3 at 180° and the oxidation of FeBr_2 at about 310° . That FeBr_2 by ignition forms FeBr_3 and Fe_2O_3 , as asserted by Löwig, is, therefore, not considered probable, as FeBr_2 is the more stable and such a formation never was observed during the present expts. On addn. of oxidizing agents (KBrO_3) the formation of Br in the second phase took place at $270-80^\circ$ and could be completed more rapidly. An expt. which was interrupted at 225° showed that all FeBr_2 remained unchanged up to this temp., while FeBr_3 was partly oxidized directly to Br and Fe_2O_3 . An expt. interrupted at 300° showed that all FeBr_2 and only a small part of the FeBr_3 was oxidized. Calcd. on the amt. of Br introduced, the av. yield was 95% as free Br and 3.1% as HBr. The expts. are described in detail and the app. used is illustrated. Though technical iron bromide generally is employed as such in the manuf. of other Br compds. the present method is important where transportation of this material over long distances is concerned; the more convenient transportation of free Br may prove economical. D. THUESEN

Bauxite and aluminum in 1926. J. M. HILL. Bur. of Mines, *Mineral Resources of U. S.* 1926, Pt. 1, pp. 51-65 (preprint No. 6, publ. Sept. 10, 1927). Cf. *C. A.* 21, 1080. E. J. C.

Phosgene. A. KONOWALOW. *Z. ges. Schiess-Sprengstoffw.* 22, 152-5(1927).—Phosgene $b_{40} 8.2^\circ$, vapor pressure at 20° 1215 mm., $d_4 1.432$. Pumice adsorbs 1.3 times its wt. of phosgene. In Germany and America the war-time production was based on the combination of CO with Cl_2 ; C was used as a catalyst. In France and Italy the early war-time production was based on the action of H_2SO_4 on CCl_4 , later production on the CO- Cl_2 process. Phosgene is both asphyxiating and toxic. The lethal concentration for man is 2.5 parts in 10,000. A concentration of 0.36 mg. per liter is lethal in 30 min. Cases of retarded action are recorded. Hexamethylenetetramine with $\text{Na}_2\text{S}_2\text{O}_8$, Na_2CO_3 , or glycerol, and activated C are used in the chemical blowing of the gas mask canister for protection against COCl_2 . Methods of use of COCl_2 in warfare are described.

J. S. REICHERT

Liquid and solid carbon dioxide as a fire extinguisher. ED. FISCHER. *Z. anorg. allgem. Chem.* 26, 57-60(1927).

R. I. DODGE

German graphite, its importance and its production. W. LANDGRAEBER. *Zentr. Halbleit. Walze* 30, 369-71; *Chem. Zentr.* 1926, 11, 2005.—The crude graphite is ground and sifted and S compds. are removed by roasting and the product is converted into flake graphite, which is used chiefly for the manuf. of crucibles. The waste dust contains 20-35% C. It is made into graphite powder in the wet way, and has various uses. Recently the greater part of the flake graphite has been ground to powder to fill the demand.

C. C. DAVIS

New process for the regeneration of fuller's earth. L. GURVICH and V. GURVICH. *Vestnik Khimicheskoy* 8, 636-9(1925); *Chem. Zentr.* 1926, 1, 1781.—The more a solvent is adsorbed by an adsorption agent, the less is the solute adsorbed and retained by the adsorbent. As a measure of the avidity with which the solvent is adsorbed, the authors utilize the heat of wetting. With fuller's earth, the series: benzene < C_6H_6 < CHCl_3 < EtOH (cf. G., *C. A.* 17, 1570) was obtained. In conformity with this, more rosin was extd. from fuller's earth, which had been treated with a soln. of rosin, by CHCl_3 than by C_6H_6 , and more by C_6H_6 than by benzene. EtOH is a bad extn. agent, because it does not dissolve rosin. If, however, EtOH is used as an "agent of removal" and C_6H_6 as the solvent, excellent results are obtained. To 30 g. of fuller's earth which had adsorbed 2.383 g. rosin was added 7.5 g. EtOH and the mixt. was extd. in a Soxhlet app. with C_6H_6 . From the fuller's earth 2.372 g. of rosin was removed. The liquids used for extn. which were retained by the fuller's earth were expelled by heating at $130-140^\circ$. This treatment suffices for the complete regeneration of fuller's earth, and with such treatment it can be used repeatedly.

C. C. DAVIS

Investigations on the adhesive properties of potato flours prepared by various methods. W. EKHARD. *Z. Spiritusind.* 50, 246-7(1927).—Potato flour was prepd. by the following methods: distd. H_2O ; tap H_2O ; H_2O soln. of 6% SO_2 , added in the amt. of 25 g. per l.; H_2SO_4 in the concn. of 1° Ré. and 5° NaOH in the amt. of 1.5 g. per l. Each sample was divided into 2 portions, one being dried at 45° , the other at 30° . Cond. H_2O and SO_2 give the best results. NaOH is the poorest. The effect of

temp. during drying was not satisfactorily detd., but higher temps. seemed to give better results.

C. N. FREY

Physical properties of dental materials. IV. Cast gold alloys. R. L. COLEMAN. *Dental Cosmos* 69, 1007-26 (1927); cf. *C. A.* 20, 2897.—A study of (1) the chem. compn., melting ranges, tensile properties, and hardness of cast dental Au alloys, (2) the density and hardness of Au foil fillings, and (3) the microstructure of these materials. J. S. H.

Deterioration of structural steels in the synthesis of NH_3 (VANICK) 9. Demonstration of the Schoenherr-Hessberger nitrogen-fixation arc (FINCH) 2.

Ammonia. H. A. HUMPHREY. *Can.* 274,568, Oct. 11, 1927. A mixt. of N_2 and H_2 , in a predetd. ratio suitable for NH_3 synthesis, is produced by gasifying solid carbonaceous fuel continuously with highly preheated gas contg. steam and O_2 at a temp. so high that little or no CH_4 is formed, the compn. of the gas being controlled in such a manner that when exposed to a catalyst, it will contain H_2 plus CO and N_2 in the predetd. ratio in a CH_4 -free mixt. H is formed by interaction of CO with steam in presence of the catalyst, and the resultant gas mixt. is purified. This purified mixt. is passed over a hot NH_3 catalyst at a high pressure in a circulatory process in which gas not synthesized in its passage over the catalyst is again passed over the same catalyst.

Recovering ammonia from solutions of ammonium salts. E. L. RINMAN. *Swed.* 62,307, Feb. 1, 1927. The soln. is boiled with a Ca silicate, for instance portland cement.

Oxidation of ammonia with oxygen or similar gases. F. G. LILJENROTH. *Swed.* 61,836, Nov. 2, 1926. A part of the gas mixt. obtained by the oxidation, consisting chiefly of N oxides, water vapor and O_2 , is cooled and used for diluting the reaction gases.

Method and apparatus for the oxidation of ammonia. F. G. LILJENROTH. *Swed.* 61,699, Oct. 19, 1926. The oxidation is carried out gradually with intermediate cooling.

Cyanides. NAAMLÖÖZE VENNOOTSCHAP NEDERLANDSCHE MIJNBOW EN HANDELSMAATSCHAPPIJ. *Brit.* 262,802, Dec. 10, 1925. Humic acid or humates such as those of alkalies or Ba, with or without sawdust or other carbonaceous materials, are coked with alkali or alk. earth compds. with or without a catalyst, to form a mass which is then treated with N to obtain cyanides.

Continuous production of cyanogen compounds. O. STÅLHANE. *Swed.* 62,711, April 5, 1927. The charge consisting of C and compds. of alkali or alk. earth metals, with or without some catalytic substance, is passed through heated tubes in the presence of N. The tubes have small dimensions, no part of the charge being removed from the nearest part of the tube wall by more than 2-3 cm. preferably, and in no case by more than 10 cm. Cf. *C. A.* 21, 362.

Crystallizing salts or other substances from solutions. G. T. WALKER. U. S. 1,644,161, Oct. 4. A crystallizable soln. is passed through a container in which a const level is maintained with overflow discharge and the soln. is progressively cooled during its passage to effect satn. of the soln. and formation of crystals; the crystals are lifted and dropped through the soln. to assist crystal formation and are advanced through the container and discharged with the outflowing soln. An app. is described.

Ferric sulfate. B. HART. U. S. 1,644,250, Oct. 4. $\text{Fe}_2(\text{SO}_4)_3$ suitable for use as active material in the purification of oils, spirits and fats is prepd. by first treating Fe oxides with only sufficient H_2SO_4 to render the Fe content sol. and then adding sufficient H_2SO_4 together with an oxidizing agent such as a nitrate and MnO_2 to produce $\text{Fe}_2(\text{SO}_4)_3$.

Solidifying aluminum chloride. C. W. HUMPHREY and D. S. MCKITTRICK. U. S. 1,645,142, Oct. 11. AlCl_3 is heated above its triple point under a pressure sufficient to restrict vaporization and hold the body of AlCl_3 in liquid form and the temp. of the vapor is then reduced without corresponding reduction of pressure.

Purifying aluminum chloride. C. W. HUMPHREY and D. S. MCKITTRICK. U. S. 1,645,143, Oct. 11. AlCl_3 contg. Fe chloride or other chlorides is heated with Al to a temp. and pressure sufficient to liquefy the AlCl_3 and cause the Al to replace the Fe or other element of the chloride impurities. U. S. 1,645,144 specifies an app. for purifying and solidifying AlCl_3 .

Precipitating copper from sulfate solutions. N. C. CHRISTENSEN. U. S. 1,643,922, Sept. 27. A CuSO_4 soln. is treated with metallic Pb while continuously mechanically removing the coating of PbSO_4 formed upon the Pb, to ppt. Cu from the soln. and form a mixt. of Cu and PbSO_4 ; the constituents of the mixt. may then be sepd. by a differential solvent such as a concd. soln. of NaCl or CaCl_2 .

Potassium and aluminum compounds from ores. R. MOLDENKE. *Can.* 273,802,

Sept. 13, 1927. Ores contg. Al are treated with an acid capable of converting the Al and K and Na compds. into sol. compds. The K compd. is sepd. from the mixt. of sol. compds. and the Al is recovered in the form of an NH_4 alum.

Apparatus for the manufacture of ammonium chloride. G. H. HELLSING and O. L. CHRISTENSON. Swed. 62,668, March 29, 1927. A horizontal cylinder with double water-cooled walls and mech. stirring device.

Table salt. F. W. HUBER. U. S. 1,645,238, Oct. 11. In prepg. a "free running" salt, approx. equal vols. of highly concd. solns. of NaCl and CaCl_2 are mixed at approx. atm. temp. and well agitated so that most of the NaCl is pptd. as small crystals, the crystals are promptly sepd., dewatered, washed with brine, left moist after removing the washings, treated with a reagent such as Na_2CO_3 for pptg. the Ca salts present, thoroughly mixed and dried.

Water-cooled tuyère for soda furnaces. E. S. SANDBERG and F. I. F. GÖTHNER. Swed. 63,121, June 8, 1927.

Solid carbon dioxide. T. B. SLATE. U. S. 1,643,590, Sept. 27. Liquid CO_2 is conducted into a chamber under sufficient pressure to maintain the CO_2 in liquid state, the pressure is reduced in the chamber to convert a portion of the liquid CO_2 into a snow like condition, gaseous CO_2 formed is withdrawn, and the CO_2 snow is compressed into a dense mass. An app. is described.

Alumina. HÖGANÄS-BILLESOLMS AKTIEBOLAG. Swed. 62,581, March 15, 1927. A supplement to Swed. 59,865; C. A. 20, 803. The mother liquor from the pptn. app. is passed counter-current to the hot gases (water and HCl) from the calcination furnace. The gases are subsequently cooled, the condensed soln. of HCl being conducted to the decompu. app. or to the pptn. app. while the uncondensed gases are conducted to the pptn. app.

Tin oxides. K. B. HEBERLEIN. Brit. 263,034, June 11, 1926. Sn oxides such as contain small quantities of As or Sb are heated in solid form (preferably to 1000° or higher) with an alkali metal carbonate or a salt such as Na_2SO_4 , in quantity proportional to the impurities to be removed, and the product is ground and leached to remove sol. impurities. The process is especially applicable to the by-product obtained in treating impure molten Pb for the removal of As, Sn and Sb as described in Brit. 213,638 (C. A. 18, 2411).

Fluorine. NAAMLOOZE VENNOOTSCHAP PHILIPS' GLOEILAMPENFABRIEKEN. Brit. 262,918, Nov. 28, 1925. Zr oxyfluoride or O-F compds. of Hf or Ti are heated in O or with an O-producing substance such as a pentoxide. The metal oxyfluoride may be made by evapg. a soln. of the fluoride almost to dryness and further drying *in vacuo* at 300° . An app. is described.

Hydrogen. G. CICALI. Can. 274,130, Sept. 27, 1927. A process for the removal of H₂ from water gas consists in previously removing a portion of the CO content, adding N_2 to the partially purified product, passing the mixt. through one of the pipes of a 3 pipe heat exchanger and then through liquid N_2 , whereby the CO liquefies and the H₂ escapes. The H₂ is delivered to another pipe of the heat exchanger and the volatile N_2 and CO are passed into the remaining pipe.

Carbon black. C. A. BARBOUR, JR. U. S. 1,643,736, Sept. 27. Hydrocarbon material such as natural gas is burned in a retort under a partial vacuum and with air proportioned to form free C; the C is sepd. and collected in the retort and the gases are then withdrawn. An app. is described.

Boiler for carbon-black retorts. H. R. ROGERS. U. S. 1,644,152, Oct. 4.

Sulfur burner. AKTIEBOLAGET KARLSTADS MEK. VERKSTAD. Swed. 62,031, Nov. 30, 1926.

Hardening colloids. A. MILLER. Can. 273,681, Sept. 6, 1927. A layer of a colloid, contg. uniformly distributed throughout it a substance which does not by itself harden the colloid, is treated with another substance, which is also incapable of hardening the colloid, but which reacts with the first-named substance, even without exposure to light, to form a hardening agent.

Condensation products of phenols and formaldehyde. E. J. P. C. DE JARNY. U. S. 1,643,447, Sept. 27. Alk. earth chlorides are used as catalysts in a quantity exceeding 15% that of the CH_2O soln. used for the condensation, to form plastic masses, cold-kneadable and sol. in acetone and in alc. The soly. decreases as the reaction proceeds without the kneadability being substantially affected.

Plastic compositions containing condensation products of formaldehyde and urea. I. G. FARBENIND. A.-G. Brit. 262,818, Dec. 14, 1925. Plastic masses, lacquers, etc., are formed by adding to urea CH_2O condensation products, preferably in an org. solvent, non-volatile or difficultly volatile substances (such as cellulose esters or ethers,

with or without plasticizing or softening agents, and natural or artificial resins) capable of forming solid solns. with the condensation products. Examples are given.

Casein compositions. W. J. HOLLOCK. Brit. 262,929, Dec. 10, 1925. Homogeneous dried pressed articles are formed by treating a tannin ext. with lime, filtering off the ppt. and mixing the filtrate with casein, $(\text{NH}_4)_2\text{CO}_3$ and paper.

Burning lime with bituminous alum slate. G. H. HULTMAN. Swed. 61,760, Oct. 19, 1926. By means of artificial draft the burning is made to proceed in the downward direction in the kiln in order to make possible the recovery of valuable by-products such as oil and sulfur.

Impregnating porous materials. A. E. EBBESSON. Swed. 63,324, July 12, 1927. The materials are treated in a closed chamber with vapors of suitable impregnating substances such as resin, asphalt, paraffin, etc., at suitable temp. and pressure. When the materials are cooled the vapors will be condensed in and on the walls of the pores without considerably changing the size of the pores.

Coating porous articles with metals. J. B. STÅLHANE. Swed. 62,329, Feb. 1, 1927. The pores of the article are filled with a suitable substance and the surface to be coated is ground in order to remove the adhering filler. After the coating has been applied the filling substance is removed by leaching with water, melting, heating with gas or in other ways in order that the article shall regain its original porosity.

Detergent composition. C. W. EBBERT. U. S. 1,644,053, Oct. 4. Cleaning cloths are treated with a soln. formed of pine oil, NH_4 oleate, NH_3 and H_2O and mixed with tripoli; the cloth is stretched and dried and is then treated with a camphor soln.

Polish. F. Y. P. LAN. Can. 274,177, Sept. 27, 1927. Lime 4, NH_3 3, gasoline 4, H_2O 16 and salt 2 oz. are mixed together, the liquid is strained off, and the product is alternately washed and strained to form a paste.

Fabric cement. N. C. AMEN. U. S. 1,643,437, Sept. 27. A cement suitable for use in repairing tents or awnings, etc., is formed of nitrocellulose 18, C_6H_6 45, "methyl acetone" 37 parts and a small proportion of BuOAc .

Machinable composition nonconductive of electricity. MARC DARRIN. U. S. 1,644,711, Oct. 11. A hard compn. adapted for use in making various articles is formed from cellulosic material such as paper pulp 20-35%, the remainder of the compn. being chiefly S, together with triphenyl phosphate, C_{10}H_8 , $\text{C}_{14}\text{H}_{10}$ or other substances.

Stencil sheet. SHINJIRO HOKRI. U. S. 1,645,141, Oct. 11. Sheets such as yoshino paper are impregnated with a compn. comprising esters of polysaccharides, e. g., mannan acetate, cellulose nitrate or acetate and chlorinated C_{10}H_8 derivs. Cf. C. A. 21, 3459.

Molding and coloring dolls or other articles formed from celluloid or similar materials. ALBERT BEYLER. U. S. 1,645,275, Oct. 11.

Rendering of non-cohesive substances cohesive. F. W. V. FITZGERALD. Can. 274,338, Oct. 4, 1927. Substances such as shredded asbestos fiber or powdered mica or slate are rendered cohesive by mixing with com. borax or similar H_3BO_3 compd. and subjecting to pressure and heat, and then subjecting the molded substance to a higher temp.

Pipe composition. A. A. POPE. Can. 274,176, Sept. 27, 1927. A pipe compn. in liquid form consists of Na_2SiO_3 thoroughly mixed with asbestos and talc, together with suitable coloring matter.

Multiply reinforced paper material impregnated with asphalt or other waterproofing substances. W. H. CADY. U. S. 1,644,050, Oct. 4.

Material for stiffening boots and shoes, etc. BRITISH UNITED SHOE MACHINERY CO., LTD. Brit. 262,838, July 7, 1925. A felt made of paper pulp mixed with longer fibers such as cattle hair is mixed with thermoplastic material such as gilsonite, montan wax and emulsified asphalt. Casein, resin size and other substances also may be used.

Lining for dental plates. E. K. PETERS. U. S. reissue 16,754, Oct. 4. See original pat. 1,589,552; C. A. 20, 3065.

Photo-mechanical printing surfaces. U. OSTWALD. Brit. 262,793, Dec. 8, 1925. In order to prevent undesirable swelling in making gelatin, albumin or glue surface printing-surfaces, the H_2O -absorbing property of the layer is reduced and its strength is increased by incorporating a non-precipitant addn. for coating individual "cells" of the layer material, e. g., a soln. of collodion in HOAc may be added to a soln. of gelatin in concd. HOAc . Various other details are given.

Gelatin for photomechanical printing surfaces. SANDOR GES. Brit. 263,125, Dec. 18, 1925. Gelatin used for making printing surfaces is treated (together with the wetting medium) with substances, such as Na_2SO_4 in decinormal soln., which reduce its swelling property and obviate the formation of elevated reliefs. The wetting medium is heated above 22° to prevent the high lights taking up greasy ink.

19—GLASS, CLAY PRODUCTS, REFRACTORIES AND ENAMELED METALS

G. E. BARTON, C. H. KERR

Concerning new problems in the production of commercial glasses. Mechanical homogenizing and the correct heat-treatment history. F. ECKERT. *Bulletin Am. Ceram. Soc.* 6, 306-8(1927). C. H. KERR

Phonolite in the manufacture of glass. W. LIEBIG. *Sprechsaal* 59, 284-5; *Chem. Zentr.* 1926, II, 95.—A discussion of various phonolites and their suitability. C. C. DAVIS

Taylor studies of the technical analyses of the raw materials for glass. II. Mineral potash. DOROTHEA JAPHE. *Sprechsaal* 60, 403-7, 424-7(1927); cf. C. A. 20, 3217.—Short methods are given for the detn. of potash salts. R. A. HEINDL

The stability of glasses in the soda-lime-silicic acid system. G. KEPPELER AND H. IPPACH. *Sprechsaal* 60, 239-41, 261-4, 281-4, 297-300(1927).—A complete review and study was made on the relation between compn. and stability of glasses in the $\text{Na}_2\text{O}-\text{CaO}-\text{SiO}_2$ system. The powder method was used in the leaching tests, a no. of labs. cooperating in making tests on glasses using this method. On the basis of the extn. detn., curves for all glasses of equal stability in the $\text{Na}_2\text{O}-\text{CaO}-\text{SiO}_2$ system were detd. and which contained the characteristic "isohydrolites." The limits of the compn. were fixed of those soda-lime-silica melts which can be commercially melted. R. A. H.

The stability of alkali-lime glass. OSCAR KNAPP. *Sprechsaal* 59, 199-201(1926); *Chem. Zentr.* 1926, II, 95.—The stability is a constitutive and additive property. C. C. DAVIS

The relation of the composition of glass to its optical constants. II. Potash-lime glass. TORU TAKAMATSU. *Repts. Imp. Ind. Research Inst. Osaka, Japan.* 8, No. 5, 1-35(1927), cf. C. A. 20, 2730.—Optical consts. of $\text{K}_2\text{O}-\text{CaO}$ glass having the compn. $X\text{K}_2\text{O} \cdot Y\text{CaO} \cdot 6\text{SiO}_2$, in which X and Y are variables, have been detd. and the following conclusions were reached. When CaO and SiO_2 are kept const., the values for n_D , n_C and n_F increase in a straight line with the increase in K_2O . The av. increase for n_D is 0.001 per 0.1 mol. K_2O . If the sum of mol. concns. of K_2O and CaO is above 2.4 the curve for n_D is a hyperbola. The total dispersion increases also in a straight line with an av. of 0.00005 per 0.1 mol. K_2O , while the γ value decreases with an av. of 0.23 per 0.1 mol. of K_2O . In case CaO is varied while the others are kept const. the same regular changes were noted. Thus, with an addn. of 0.1 mol. CaO an av. increase of 0.0025 is noted for n_D , of 0.000065 for total dispersion and an av. decrease of 0.192 for γ value. When the sum of the mol. concns. of CaO and K_2O is above 2.4, the curve for n_D is a shallow hyperbola, while those for other consts. remained straight. NAO UYBI

Changes taking place in optical glasses. P. NICOLARDOT. *Rev. gén. colloïdes* 5, 445-9, 491-6, 539-43, 592-8(1927).—A review. A. PAPINEAU-COUTURE

The absorption of optical glasses and borax below 4.1μ . TH. DREISCH. *Z. Physik* 42, 428-34(1927).—The absorption of optical glasses is extremely small up to 2.7μ ; from this point it is very much increased. In glasses contg. H_2O_3 there are sharp bands at 2.8, 3.68 and 4.05μ ; the strength of these bands is incrd with increasing amounts of B_2O_3 . They correspond to the bands of borax at 2.95, 3.65 and 4.1μ . The SiO_2 content of the glasses causes diffused bands at 2.85 and 3.55μ . J. A. S.

The absorption of quartz and quartz glass below 4.1μ . TH. DREISCH. *Z. Physik* 42, 426-7(1927).—The quartz band at 2.9μ used for adjustment is not as sharp as is generally supposed; it shows fine structure. The quartz has 3 max. at 2.91, 2.97 and 3.02μ . The quartz glass shows a very intensive max. at 2.75 , which is better suited for adjustment purposes than the band of the cryst. quartz. The quartz glass used was pure SiO_2 from Heraeus, the difference in the band of the two is caused by the destruction of the crystals during fusion. Between 3.1 and 4.1μ the two absorption curves are identical; at 3.75μ there is a band which is so far unknown. J. A. SZILARD

Design and service of (glass) tank blocks. D. W. ROSS. *J. Am. Ceram. Soc.* 10, 774-83(1927). C. H. KERR

The compounding of lead glasses. OSCAR KNAPP. *Sprechsaal* 60, 226-8, 242-3(1927).—A discussion with data in connection with K.'s work on "The Keppeler Principles of Lead Glasses." R. A. HEINDL

The course of the crack in the breaking up of solid (lump) glasses through blow or impact. HANS JEBSEN-MARWEDEL. *Sprechsaal* 60, 317-21(1927).—A technical analysis of the fracturing of solid lump glass due to impact. R. A. HEINDL

The storage and packing of glassware. G. GEHLHOFF AND R. SCHMIDT. *Sprechsaal* 60, 336-40, 353-6(1927).—The harmful effects of moisture absorbed from the atm. on glasses of different compns. were investigated. Photomicrographs illustrating these effects as well as those due to packing materials are given. R. A. HEINDL.

Method for complete [glass] sand analysis. STANDARDS COMM., GLASS DIV., AM. CERAM. SOC. *Bulletin Am. Ceram. Soc.* 6, 321-4(1927).—A method is given in detail for CaO, MgO, ignition loss, Fe₂O₃, TiO₂, ZrO₂, Al₂O₃, SiO₂. C. H. KERR

The technical development of the ceramic industry. ANON. *Industrieldningen Norden* 55, 394-7(1926).—A review. C. A. ROBAK

The role of the ceramic petrographer. A brief review of the development of the ceramic petrography. A. B. PECK. *Bulletin Am. Ceram. Soc.* 6, 297-305(1927).

C. H. KERR

Dry grinding clay to eighty-mesh. D. F. ALBERY. *J. Am. Ceram. Soc.* 10, 804-6(1927).

C. H. KERR

The manufacture of green gold. F. CHEMNITIUS. *Sprechsaal* 60, 313-4(1927).—A discussion on the manuf. of gold preps for ceramic purposes including a diagrammatic sketch showing substances and their relative position to one another which enter into reactions leading to the formation of green and burnished gold. R. A. HEINDL

The role played by water in the forming of clay objects. HERMANN SALMANG AND ALFRED BECKER. *Sprechsaal* 59, 389-90, *Chem. Zentr.* 1926, II, 1321.—By mixing kaolin with liquids of different compns., it was found that only with liquids which contain acid or alc. groups can plastic masses be formed. The H₂O which is represented in each type of compd. (H, OH) may play a part in the plasticizing in virtue of its chem. nature, for hydrocarbons have no plasticizing action. Besides the chem. nature of a liquid, the viscosity of the liquid detcs. its plasticizing action. Substances which can be molded only with difficulty, e. g., steatite and mica in a very fine state of subdivision, show the same properties as kaolin, but to a less extent. With these substances, the viscosity plays a more prominent part in the plasticizing action. Graphite, which has no chem. affinity, can be formed into a plastic mass only with viscous liquids. The results show that chem. action plays a part in molding clays and kaolins. C. C. D.

Steatite porcelains. LADISLAUS VON PUTNOKY. *Chem. Rundschau Mitteleuropa Balkan* 3, 66-9; *Chem. Zentr.* 1926, II, 1321.—Steatite products from the pure powder must be baked at 1450°, whereas a thick object in which there is also 15-30% clay and water can be baked at 1200-1300°. Such products can be manufd. more cheaply than ordinary porcelain products, shrink less and possess great elasticity. Products intermediate between pure steatite and steatite porcelains can also be made. C. C. D.

Waste-heat boiler plants attached to circular ceramic furnaces. ED. FROMME. *Arch. Warmewirt.* 8, 279-82(1927).—The installation illustrated and described recovered 53% of the heat in the fuel used. ERNEST W. THIBLE

Electric kilns at the Gustavsberg works. A. S. W. ODELBURG. *Trans. Ceram. Soc. (Eng.)* 26, 61-73(1927).—Data are given on the elec. firing of porcelain cups. H. F. K.

New viewpoints in the use of refractory construction in the metal industry. K. ENDELL. *Metall u. Erz* 24, 225-30(1927).—Discussion of the drying of Zn stills and the use of tests based upon resistance to change of temp., high temp., and chem. corrosion. Drying should include consideration of the vapor pressure of the H₂O in the mold, the humidity and velocity of the air and the phys. consistency of the mold. C. G. K.

Notes on the analysis of refractories. W. J. REES. *J. Soc. Glass Tech.* 11, 172-6(1927).—While the usual methods applicable to the analysis of glass can be applied to most refractories, greater care must be observed in preventing contamination in the prepn. of the samples of refractories. In the SiO₂ detn. after Na₂CO₃ fusion it is shown that the Fe₂O₃ and TiO₂ impurities taken up increase progressively from 6 to 11 mg. and 2 to 3 mg., resp., as the baking temp. after evapn. to dryness is increased from 105° to 120°. With refractories of bauxite the TiO₂ contained in the SiO₂ residue may be 12-15 mg. The Al(OH)₃ pptn. from a soln. neutral to methyl red is most convenient. The wash soln. suggested contains per l. 5 cc. concd. HNO₃ neutralized with NH₄OH. The other constituents are detd. as usual. The short method of analysis of SiO₂ brick is: Treat with HF and H₂SO₄ twice for SiO₂ detn., digest the residue with strong NH₄OH, filter, evap. the filtrate, and add 50 cc. Gooch and Eddy's soln. contg. NH₃ and (NH₄)₂CO₃ in an alc. soln., filter, evap. to dryness and det. the alkalis as mixed sulfates. With MgO refractories it may be necessary to fuse with Na₂CO₃ since the dead burnt MgO is slowly sol. in HCl. For the detn. of Al₂O₃ in chrome refractories R. advises Na₂O fusion, followed by the pptn. of Al as the basic carbonate with a slow stream of CO₂ overnight. Steam under pressure was not successful in opening up the silicates of re-

fractories. Na_2O_2 fusion is necessary in dissolving sillimanite and mullite for analysis.

Analysis of high-alumina clays and refractories. W. SINGLETON. *Chem. Age* (London), *China Clay Trade Review Sec. 17*, No. 420, 6; No. 425, 6-7(1927).—Details of procedure are given, with slight modifications of well-known methods. C. H. K.

Notes on cyanite and diaspore refractories. H. J. VACHUSKA AND G. A. BOLE. *J. Am. Ceram. Soc.* 10, 761-73(1927).—Mixts. of diaspore and cyanite, diaspore and clay and cyanite and clay were tested. Results are tabulated and discussed. Burns were made at cones 12, 16, 20 and 28. Adding 20% or more cyanite to diaspore tends to counteract the shrinkage of diaspore during continued use at high temps. C. H. K.

Experience with refractories in furnace construction. L. W. BRIGGS. *The Clay-Worker* 88, 194-5(1927).—Some of the factors affecting the life and use of refractories and the probable lines of development are indicated. L. B. MILLER

Magnesia refractories for steel furnaces. G. M. CARRIE AND C. F. PASCOE. *Can. Mining Met. Bull.* No. 186, 1186-1272(1927).—A discussion of uses, properties, comparison with other refractories, application in steel furnaces, and service in operation. A. BUTTS

Spalling and loss in compressive strength of fire brick. H. R. GOODRICH. *J. Am. Ceram. Soc.* 10, 784-94(1927).—Loss in compressive strength after thermal shock seems to be a good means of detg. resistance to spalling. Bricks with high quartz content in kaolin bonds showed low initial crushing strength, but retained a higher % of its strength after thermal shock than did the fireclay types (testing at 1350°). In tests at 1250° individual characteristics rather than type properties prevailed. A vitrified or brittle structure showed the poorest resistance to spalling. C. H. KERR

A study of flue lining [in chimneys]. R. A. HART AND H. W. CLARK. *J. Am. Ceram. Soc.* 10, 795-803(1927). C. H. KERR

A preliminary study of ceramic colors and their use in vitreous enamels. W. N. HARRISON AND T. D. HARTSHORN. *J. Am. Ceram. Soc.* 10, 747-60(1927). C. H. K.

Principal observations to be noted in the cooling of enamels. TH. SCHAUER. *Sprechsaal* 60, 238-9(1927).—The following conclusions are given which will lead to the improvement of enamels: the amt. of crystn. of the enamels should be reduced to a min.; control of time and temp. of annealing corresponding to the enamel used permit the greatest development of cast pearlite; uniform cooling in such a manner as to eliminate large temp. differences between enamel and Fe. R. A. HEINDL

Enamel colors resistant to acids and their testing. EISENLOHR. *Sprechsaal* 59, 645-6; *Chem. Zentr.* 1926, II, 2472.—The resistance to acids of enamel colors does not increase with increasing SiO_2 content. All enamels contg. between 1.3 and 2.0% SiO_2 to 0.7 PbO + 0.3 Na_2CO_3 are resistant to acids. Acid-resistant enamels give up only 0.1-0.01 as much to acids as ordinary enamels. They are tested with 3% HCl in which the baked enamel is immersed for at least 5 hrs. This treatment should not detract from the brilliancy of the enamel, even when it is thick. C. C. DAVIS

Uranium oxide colors and crystals in low temperature glaze combinations. J. R. LORAIN. *J. Am. Ceram. Soc.* 10, 813-20(1927).—By using only U_3O_8 and Pb_3O_4 it is possible to produce any shade from yellow to dark orange or red. About 10% of yellow U_3O_8 will produce deep orange. Volatilization of Pb is an important factor in crystal growth. C. H. KERR

The salt glaze. BERNHARD NEUMANN AND WERNER FISCHER. *Sprechsaal* 60, 294-7, 314-7, 331-4, 349-52(1927).—An extended investigation on the reactions of NaCl with the various substances making up bodies of salt-glazed articles and the effect of steam as well as either reducing or oxidizing atm. R. A. HEINDL

General notions on the glazed earthenware. L. DELOYERS. *Bull. soc. chim. Belg.* 36, 55-63(1927).—An address. A. L. HENNE

Why is it impossible to obtain deep, bright, full colors (tints) in cover glazes (enamels, etc.)? JOSEF WOLF. *Sprechsaal* 60, 219-26(1927).—When cover glazes were used as ground coats, no deep bright colors were obtained as with transparent glazes. The reason why no deep full tints are obtained with opaque (white) enamels may be found in the strong reflection of such enamels. R. A. HEINDL

The determination of boric acid in silicates (SCHMIDT) 7. The analysis of silicate slags (COLCLOUGH) 7. Waste heat utilization (WADE) 13. Arsine from fused glass (ELSEY) 2.

Sheet glass. L. SHOWERS. U. S. reissue 16,755, Oct. 4. (Original pat. 1,603,989; C. A. 21, 164.) Mech. features.

Forming sheet glass. G. E. HOWARD. U. S. 1,645,053-4, Oct. 11.

Apparatus for making sheet glass. H. R. SCHUTZ. U. S. 1,643,680, Sept. 27.

"Unsplinterable" glass. E. HOPE. U. S. 1,644,131, Oct. 4. Glass sheets are united with an intervening sheet of cellulose acetate or other suitable cellulose ester, by the use of a polymerized itaconic ester, *e. g.*, polymerized di-alkyl esters of itaconic acid.

Treating glass with stannous chloride and silver-depositing solutions. E. D. TILLYER AND H. R. MOULTON. U. S. 1,644,798, Oct. 11. Glass such as is to be treated with a Ag soln. for producing markings on the glass is preliminarily treated with a soln. of SnCl_2 in order to form markings rendered visible by moisture or developed by dil. Ag solns., etc.

Protecting silvered glass. SOC. ANON. DES MANUFACTURES DES GLACES ET PRODUITS CHIMIQUES DE ST.-GOBAIN, CHAUNY, ET CIREY. Brit. 262,824, Dec. 14, 1925. The silvered surface is coated with a soln. of a synthetic resin in a solvent having a b. p. lower than 100° and the glass is then heated to polymerize the resin.

Feeding charges of molten glass. WM. T. BAKER, JR. U. S. 1,645,221, Oct. 11. Mech. features.

Device for feeding molten glass. K. E. PEILER. U. S. 1,644,893, Oct. 11.

Glass-molding machine. AKTIEBOLAGET SURTE-LILJEDAHL. Swed. 62,850, April 27, 1927.

Discharge control device for glass furnaces. D. S. BEEBE. U. S. 1,643,601, Sept. 27.

Removing gas from melted glass or quartz. C. A. F. BENEDICKS. Swed. 63,106, June 8, 1927. The melted mass is stirred by means of a rod or other article hotter than the glass bath; the sepn. of the gases is localized on this stirrer.

Porous clay product. E. I. LINDMANN. Swed. 62,968, May 10, 1927. Clay from quaternary deposits is heated with successive increases in temp. to a temp. near the m. p., then more slowly until the mass reaches a state of viscous fusion in order to facilitate the expansion of the inclosed gases; after this the burning is discontinued.

Porous bricks, etc. F. C. KERN and F. E. KERN. Brit. 262,826, Dec. 14, 1925. Sawdust or other fibrous material which is to be mixed with clay and subsequently burned out to leave a porous product is heated to $200-325^\circ$ either before or after admixt with the clay but before molding, in order to volatilize moisture and other volatile substances which would tend to cause rupture of the material in burning. Substances such as fuller's earth, kieselguhr, silicic acid or bentonite also may be added. Cf. C. A. 20, 3340.

Tile. E. G. BARRATT. U. S. 1,645,214, Oct. 11. Tiles are formed with a main body of gypsum plaster, a fibrous cover sheet and a coating of paint enamel over the fiber sheet.

Aggregate for use in making brick or other molded articles. S. J. HAYDE. U. S. reissue 16,750, Sept. 27. Clay, shale, shale rock or other raw argillaceous material contg. a lime-forming substance is burned, mixed with H_2O to slake the lime present, and the product is crushed. (See original pat. 1,255,878; C. A. 12, 986.)

Clear vitreous silica. H. L. WATSON. U. S. 1,645,080, Oct. 11. Cryst. SiO_2 is heated *in vacuo* to a temp. sufficient to effect fusion and is then heated for a short time to above 2000° in the presence of air or other suitable gas under substantial pressure, *e. g.*, at 2300° under atm. pressure.

Forming silica tubing from rods. E. R. BERRY and P. K. DEVERS. U. S. 1,645,086, Oct. 11.

Abrasive sheet. G. E. BEHR, JR. U. S. 1,645,037, Oct. 11. A sheet such as paper is impregnated with cottonseed oil or other suitable waterproofing agent and the abrasive grit is held to the sheet by a separately applied and different material which is miscible with the impregnating medium, *e. g.*, a mixt. of tung oil, linseed oil, rosin and gasoline.

Refractory material. M. L. FREED. U. S. 1,644,244, Oct. 4. A material suitable for furnace linings and like uses is prepd. by calcining a compn. contg. topaz and an anhyd. Al silicate to cause conversion to mullite, molding the mullite with a temporary binder and then firing at a temp. which will convert the particles into a homogeneous mass.

Refractory material. G. B. LUCKETT and J. A. JOHNSON. U. S. 1,643,988, Oct. 4. A refractory coating material adapted for use as a mortar with clay and SiO_2 brick comprises acetylene plant waste (mainly Ca(OH)_2) of a thick creamy consistency 1 gal and NaCl 1 oz.

Forming refractory linings for electric furnaces. D. L. SUMMEY. U. S. 1,643,425, Sept. 27. Mech. features.

20—CEMENT AND OTHER BUILDING MATERIALS

J. C. WITT

Investigations of the constitution of portland cement. ERNST JÄNECKE. *Tonind. Ztg.* 51, 1246-7(1927).—The importance of the mineral jänneckite, $8\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot \text{SiO}_2$, in portland cement is reiterated. Cf. *C. A.* 20, 3068. F. O. A.

Aluminous fused cement and its application for reinforced concrete construction and stucco. ORTHAUS. *Tonind. Ztg.* 51, 1130-5, 1151-3(1927).—After making careful tests, considerable amts. of aluminous cement were used around a gas works to very good advantage where its high early strength, even in cold weather, as well as its resistance to sulfate waters were deciding factors in its choice. Applied as stucco best results were obtained on portland concrete at the age of 14 days or on aluminous concrete at 21 hrs. Reports are given of extensive and successful patching of old corroded portland concrete. F. O. A.

Roads to supercements. HANS KÜHL. *Tonind. Ztg.* 51, 1245-6(1927).—The proper grinding and mixing of the raw materials and the correct burning and grinding of the clinker are important as well as the chem. compn. Too fine grinding of the clinker may result in flash set, or in too bulky a cement or may increase laitance. It is suggested that the fact of the low tensile strength relative to the compressive strength may be taken as an indication of concealed unsoundness in present-day high-lime supercements. The early strength of Velo cement is obtained by increasing both the silica and lime with the addn. of some fluorspar to control the burning temp. In Kühl cement Fe and Al are high while silica and lime are a little low. In Novo cement CaCl_2 seems to play an important role. The future lies in searching for catalysts or promoters but the lack of scientific knowledge of the hydration and hardening processes hinders the search. F. O. ANDEREGG

Physical transformations undergone by cement during hardening. CESARE ZAMBONI. *Giorn. chim. ind. applicata* 8, 469-72(1926).—The quality of a cement depends upon its property of combining in the smallest possible time with a large amt. of H_2O , since the greatest compactness is immediately reached and hence the greatest resistance to compression. The greater the fineness, the more rapid is the hardening. To a greater resistance there always corresponds a strong diminution of the sp. gr.; hence there is a greater increase of vol. with relatively greater compactness. The difference in the sp. gr. of an agglomerate and that of the same material after hardening for a given time in H_2O is a criterion of its resistance. As an alternative, the difference in sp. gr. of a cement after 24 hrs. in intimate contact with H_2O and that after 48 hr. contact gives a measure of its intrinsic value. The cement will show a greater resistance, the greater the decrease in sp. gr. between these 2 periods. The system of calcination of the cement, i. e., the use of different kinds of kilns, has an appreciable influence upon the quality of the cement. ROBERT S. POSMONTIER

The tensile strength of cement and its significance for building purposes, especially for early-strength cements. H. SPANGENBERG. *Beton Eisen* 26, 16-9(1927).—The tensile strength of early-strength cements often does not increase as rapidly as the compressive strength; reliance placed upon the latter kind of results might lead to misapplication where the tensile strength is the more important property. The desirability of also making tensile tests as is done in America is emphasized. F. O. A.

The tensile strength of hydraulic cements. CARL BIEHL. *Tonind. Ztg.* 51, 1253-5(1927).—The ratio of compressive to tensile strength tends to approach a const. value in time. The ratio is helped by a correct choice of aggregates. F. O. A.

Standards for portland cement. HÄGERMANN. *Beton Eisen* 26, 153-4(1927).—General remarks. F. O. A.

Ring and ball formation in the rotary kiln. H. RICHARZ. *Tonind. Ztg.* 51, 1257-61(1927).—No positive conclusions. F. O. A.

The effect of water on the recrystallization of slightly soluble substances. B. GARRE. *Tonind. Ztg.* 51, 1440-2(1927).—Pellets 10×7 mm. were compressed at 715 kg. using: (1) quartz powder, (2) pptd. Al_2O_3 , (3) fused Al_2O_3 , (4) CaCO_3 , (5) Na_2CO_3 , (6) $10\text{Na}_2\text{CO}_3 + 90\text{Al}_2\text{O}_3$, (7) CaF_2 , (8) $10\text{CaF}_2 + 90\text{Al}_2\text{O}_3$, with varying amts. of water at room temp., at 500° and at 900° . The strength and pore space were observed. The latter decreases as more water is added. The strength usually increases with the water and with heating, except the strength developed at 500° by (1). Both 1 and 3 give low strengths while 2 and 4 yield fairly good strengths. The amt. of water absorbable depends upon the grain size. F. O. ANDEREGG

The testing of protective coatings for concrete. RICHARD GRÜN. *Tonind. Ztg.* 51,

1253-5(1927).—A series of tarry and asphaltic materials suitable for applying to concrete was examined for appearance, compn., sp. gr., workability and spreading power, tenacity, drying capacity, strength, elasticity, compactness, and resistance against heat, moisture and chemicals. A preliminary set of standard specifications is outlined.

F. O. ANDEREGG

Early-strength cement and concrete. SPINDEL. *Beton Eisen* 26, 9-16(1927).—General remarks on the history of early-strength cement in which S. played an important part. Also a good description of present-day practice in central Europe. S. emphasizes the necessity of having a proper clinker for high-grade cement and points out that the quality tends to improve often up to fusion. The new Kühl cement is described with some enthusiasm.

F. O. A.

Highest early-strength mortar and concrete. SPINDEL. *Beton Eisen* 26, 111-3(1927).—By the use of high-grade cement and certain admixts. (not given) it is claimed that the securing of the old 28-day strength is possible in 6 hrs.

F. O. A.

Mistaken conception and rules for concrete making. SPINDEL. *Tonind. Ztg.* 51, 1325-7(1927).—Some mistakes in practice include the old idea that a long curing period is necessary before removing forms, the use of the ideal curve or void method for proportioning the aggregates, and the viewpoint that the water-cement ratio is the whole story in making good concrete.

F. O. A.

Temperature developed in high-alumina concrete. T. H. CUTLER. *Eng. News-Record* 99, 146(1927).—A curve is given showing the temp. developed in high-alumina cement concrete poured when the air temp. was slightly below freezing.

R. H. T.

Quality design and control of concrete. J. A. KITTS. *Eng. News-Record* 99, 232-3(1927).—Essential control measures for producing quality concrete with economy are outlined.

R. E. THOMPSON

Influence of the water-cement ratio on the strength of concrete. F. R. McMILLAN. *Contract Record Eng. Rev.* 41, 554-5(1927); cf. *C. A.* 21, 1695.—Expts. are described which show that concrete of uniform strength of any desired workability can be obtained by keeping the water-cement ratio const. and varying the mix, whereas workability is only obtained at the expense of quality when additional water is employed.

R. E. THOMPSON

Method for testing bond between concrete and its reinforcing. R. C. DURST. *Eng. News-Record* 99, 402(1927).—A brief description of a simple method for detg the bond between concrete and steel reinforcing consisting of carrying out the test in the usual manner on specimens prepd. in pipe sections 3 in. in diam. and 8 1/2 in. long. This prevents compression of the concrete which probably exerts a pressure against the rod.

R. E. THOMPSON

The significance of the cement stone in poured concrete. GAYE. *Beton Eisen* 26, 237-44, 270-3(1927).—The production of concrete is considered from the standpoint of the cement combining with water to form a stone which binds the aggregate into a hard mass. The effects of the cement-water ratio and the addn. of fine rock powder are discussed.

F. O. A.

Cement, mortar and concrete for pouring. A. GUTTMANN. *Beton Eisen* 26, 113(1927).—Studies are given of the effect of water content on the strength, consistency, vol. weight and vol. constancy of portland cement and of mixts. of portland cement and granulated slag.

F. O. A.

The behavior of mortar and concrete at low temperatures. OTTO GRAF. *Beton Eisen* 26, 244-52(1927).—During cold weather care should be taken to use only first class aggregates and to place the material properly. Frost should be allowed to act upon the concrete only after it has reached the strength usually reached in 24 hrs. at 15° to 20°. If the concrete is exposed to freezing when satd. with water its strength should be at least 150 kg./sq. cm.

F. O. A.

The destruction of reinforced concrete structures in a Java harbor. W. LOOS. *Beton Eisen* 26, 89-99(1927).—Numerous examples are given with photographs of reinforced concrete which had been destroyed. The recommendations given are in accordance with the best practice developed recently.

F. O. A.

Protection of concrete against alkali. Further tests by the bureau of public roads on the treatment of concrete with tar and paraffin. E. C. E. LORD. *Public Roads* 8, 105-12, 119(1927); cf. *C. A.* 20, 2056.—Photographs and tables are given.

A. E. GRAY

Effect of calcium chloride and road slab concrete. H. P. OLSON. *Eng. News-Record* 99, 69(1927).—The av. strengths of concrete specimens contg. 0, 1 and 2% CaCl₂ were about equal at 7 days, but those contg. CaCl₂ averaged 700 lbs. less at 28 days than plain concrete cured in a moist closet. Compared with plain concrete

not cured in any way, the strength of concrete contg. CaCl_2 was slightly higher at 7 days but lower at 28 days. Examn. of cores drilled after completion of the work showed a surface-cured concrete had a much higher av. strength and smaller variations in strength than concrete in which CaCl_2 had been incorporated. Brief data on cracking of the finished paving are given.

The economies of concrete mixes for road works. R. T. GILES. *Eng. News-Record* 99, 512-3(1927).—It is concluded: (1) that a 1:2 ratio of cement and fine aggregate gives the best results as regards both economy and wearing surface when using portland cement; (2) that as much coarse aggregate should be used as the voids will permit so long as workability is satisfactory; and (3) that the transverse stress of the slab should be the criterion in preference to the compressive strength of the concrete.

R. E. THOMPSON

Physical chemistry and the road problem. GEORGES BAUME. *Bull. soc. chim. Belg.* 36, 469-84(1927).—A lecture, with special reference to the recent developments in France.

A. L. HENNE

Fire-resistant construction. R. F. STRADLING AND F. L. BRADY. *Dept. Sci. Ind. Research, Brit. Building Research Rept.* No. 8, 57 pp.(1927).—The fire-resistant properties of metals, timber, natural rocks and artificial products are reviewed. Expts. were made to find a fire-resistant mortar and concrete which should be as free from free lime as possible and should also contain no quartz and little calcite. To combine with the lime set free during hydration of portland cement various finely ground pozzolanic materials were added to the cement and it was found that certain clays heated to about 850° and certain slags gave fairly good results. For aggregate well-burned brick is recommended both as sand and as coarse material. A concrete which will regain much of the strength lost during heating on being treated with water is desirable. Coal ashes must be used with caution.

F. O. ANDEREGG

Studies on calcium sulfate. III. New methods for the analysis and use of plaster. I. CHASSEVENT. *Ann. chim.* 7, 43-68(1927); cf. C. A. 21, 3297.—The chem. analysis of the burned plaster gives insufficient information on the proportion of $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$, $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$ and $\alpha\text{-CaSO}_4$ formed above 300° and $\beta\text{-CaSO}_4$ formed below 300° . $\alpha\text{-CaSO}_4$ can be detd. by the calorimetric method: 2-4 g. of the plaster are added to water in a Dewar vessel and agitated; the disengagement of heat observed after 2-3 min. is a measure of the CaSO_4 present. If x is the amount of heat evolved expressed in small calcs. the wt. (p) of the CaSO_4 is given by the formula $p = (x - 20)/20$; 20 is the correction corresponding to the heat of the dissoln. of $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$ to satn. If only the proportion of CaSO_4 is to be detd. about 10 g. are used in order to decrease the influence of the correction. The insufficient hardening of plaster is caused by the presence of $\alpha\text{-CaSO}_4$. Two methods were developed to measure the time required for the hardening of plaster, which contains $\alpha\text{-CaSO}_4$. (1) If the plaster does not contain any $\alpha\text{-CaSO}_4$ the elec. resistance of a mixt. with water does not increase during several hrs. (2) CaSO_4 is calcd. from the increase in wt. of the plaster covered with water. Dihydrate modifies the qualities of plaster if present even in very small quantities; it accelerates crystn. The transformation of 1 g. of $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$ to $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ liberates 25 calcs. All disengagement of heat observed after the first 3 min. is caused by the crystn. of the dihydrate. Plasters burned at various temps. were examd. and their heat-evolution time curves detd. The d. and resistance against compression of $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ were detd. Between d. 1.757 and d. 2.18 the resistance against compression increases rapidly. Alabaster has a d. 2.32 with a corresponding high resistance. Attempts to prep. synthetic alabaster by maintaining a high pressure during the setting of the material failed; the substance obtained was opaque and had a low d. The velocity of crystn. of the dihydrate is very great, therefore the use of mechanical appliances for the mixing of the plaster are not feasible; only above 60° is it slow enough to make the preservation of a CaSO_4 and H_2O mixt. without crystn. for a longer period possible.

J. A. SZILARD

The suitability of gypsum for wall plaster. H. J. SCHWEIM. *Contract Record Eng. Rev.* 41, 565-7(1927).—The properties of gypsum which make it suitable for wall plaster are inherent strength, rapid setting and resistance to fire, heat transfer and sound transmission.

R. E. THOMPSON

Diffusion of water-soluble materials in impregnated woods. R. NOWOTNY. *Z. angew. Chem.* 40, 1060-2(1927).—Sherefesee (U. S. Forest Service Circular 132(1908)) concluded that in ties treated with ZnCl_2 no appreciable diffusion of the impregnant took place after the said treatment ended. By plotting Sherefesee's data graphically the author states that a movement of the ZnCl_2 (by diffusion) to the center is indicated clearly. The value of the Cobra process, i. e., applying the preservative as a paste

to the wood and allowing it to diffuse slowly into the wood, is thereby confirmed.

W. C. EBAUGH

Possible use of shale oil as a wood preservative. A. M. SOWDER. *Ind. Eng. Chem.* 19, 1180-2(1927).—Effects of pyridine and quinoline on *Fomes annosus* show the former to be of little value. The latter compares favorably with other fungicides. Shale oil contg. about 3% quinoline would be effective on wood if injected at the rate of 12 lb. oil per cu. ft. of wood.

BRIAN MEAD

The freeness test in roofing felt manufacture. P. W. CODWISE. *Paper Trade J.* 85, No. 4, 52-4(1927).—A tester which has given satisfactory results in controlling the freeness of roofing stock consists essentially of a vertical glass tube about 1 7/8 in. internal diam. and over 25 in. long, fitted at the bottom with a 50-mesh wire-cloth screen and with marks indicating vols. of 200 cc. and 1050 cc., measured from the bottom. Means are provided for sealing the bottom of the tube and subsequently releasing the same to give an unobstructed flow through the wire screen. The detn. is carried out by filling to exactly the 1050-mark with stock at 80° F contg. exactly 1 g. of fiber in 300 cc., releasing the sealing device at the bottom of the tube, and noting the time (in sec.) required for the level of the liquid to fall to the 200-mark. Duplicate results (within 1-2 sec.) are readily obtained. Representative examples are given of the type of results obtained with different kinds and wts. of felts. The application of the test to mill control is briefly discussed.

A. PAPINEAU-COUTURE

The utilization of bituminous rock (LANDGRAEBER) 22. Testing of road oils (SCHAFER) 22. Bituminous emulsion for use on roads (U. S. pat. 1,643,675) 22. Bituminous composition for paving, roofing or other purposes (U. S. pat. 1,643,520) 22. Bituminous composition containing rubber (Brit. pat. 263,028) 30.

Cement. S. L. A. ODÉN. Swed. 62,701, March 29, 1927. The ground cement is sepd. into several groups of different grain sizes, each of the resulting products, alone or in mixts. of two or more such groups, forming cements with other hydraulic properties.

Cement. M. LANTZ. Swed. 63,382, July 19, 1927. After the clinker has been ground with addn. of a suitable amt. of gypsum, the ground mixt. is for a second time passed through a grinding mill where an extra quantity of gypsum is added and is ground and mixed intimately with the cement.

Waterproof cement. H. V. WELCH. U. S. 1,644,964, Oct. 11. Portland cement is mixed with 5-10% of diatomaceous earth together with hydrocarbon material naturally occurring with the diatomaceous earth. U. S. 1,644,965 specifies similar mixts which may contain oil-bearing shale.

Molding articles from magnesia cement. AKTIEBOLAGET MARINBETONG. Swed. 61,693, Oct. 12, 1926. The molding is carried out in an inwardly polished mold prepd by electrolytic pptn. with a thickness of about 2 mm. After hardening the article is made to slip by subjecting the mold to a sudden violent heating of short duration, the article itself remaining cold.

Slag cement. I. G. FARBERIND. A.-G. Brit. 263,124, Dec. 15, 1925. Slag obtained from the fusion of phosphate, sand and C with elimination of P or its oxides is converted into cement by addn. of calcareous, aluminous or like materials after it has left the furnace and while it is still molten.

Fireproof mortar. R. L. TAYLOR. U. S. 1,645,030, Oct. 11. A mortar suitable for use in hard finish plastering comprises the residue obtained by burning coal mine slate and waste (commonly called "red dog"), ferro-Mn slag and a binder such as cement.

Multi-ply felt roofing material saturated with bituminous composition. L. KIRSCH BRAUN. U. S. 1,644,652, Oct. 4.

Fire-resistant fibrous material. ALEX. WINOGRADOFF. U. S. 1,645,172, Oct. 11. Combustible fibrous material such as wood is treated with a mixt. of a soln. of MgSO₄ or other H₂O-sol. Mg salt and a soln. of a H₂O-sol. bicarbonate such as KHCO₃ and the material is subsequently heated to ppt. MgCO₃ in the fibers. U. S. 1,645,173 relates to similar solns. for the same purpose.

Wood preservative. STOCKHOLMS SUPERFOSFAT FABRIKS A.-B. Swed. 62,685, March 29, 1927. The active preserving component consists of a mixt. of one or more sol. F salts, phenols or phenol ethers and neutral water-sol. salts of sulfonated phenols or phenol ethers. By regulating the ratio between the salts of sulfonated phenols and the unsubstituted phenols a suitable soly. of the preservative can be attained.

Wood preservative. K. H. WOLMAN. Can. 273,656, Sept. 6, 1927. A wood preservative, which is stable with respect to Fe, consists of mixts. of NaF and Na₂SiF₆.

21—FUELS, GAS, TAR AND COKE

A. C. FIELDNER

American fuel resources. O. P. HOOD. *Mech. Eng.* 49, 1061-2(1927). E. J. C.

Notes on recent developments in fuel technology. R. WIGGINTON. *Fuel in Science and Practice* 6, 289-92, 337-9(1927); cf. *C. A.* 21, 1174.—Short reviews upon the following subjects: the K. S. G. low-temperature carbonization process, coal carbonization, ovens for gas manufacturing, coke cooling, a steam pressure transformer, petroleum refining, the "Eddystone" app. for boiler flues, the Benson boiler, flame temps., ploughing with producer gas.

D. A. REYNOLDS

Minimum or maximum heating value (of fuel)? A. D. HUDLER. *Gas u. Wasser-fach* 70, 917-9(1927).—A plea for the use of heating values of fuel corrected for the effect of any moisture ("minimum heating value") when computing efficiencies as in gas producers.

R. W. RYAN

The retention of certain hydrocarbons by solid fuels. B. MOORE AND F. S. SIN-NATT. *Fuel in Science and Practice* 6, 312-8(1927).—Tests designed to det. the absorption of benzene, toluene and xylene by bituminous coal, anthracite, Irish peat, gas coke, animal charcoal and wood charcoal were made as follows: Three g. samples of 200 mesh material were air dried 1 hr., at 105°, cooled in H₂SO₄ desiccators, weighed and permitted to stand in H₂SO₄ desiccators contg. the hydrocarbons in shallow dishes at 16° for definite time intervals and re-weighed. Retention of hydrocarbons was then detd. by weighing the samples after standing in air, corrections being made for changes in humidity. Peat and coke absorb much smaller quantities of hydrocarbons than the other fuels tested. The rate of loss of absorbed hydrocarbons is rapid during the first 40 hrs., then decreases more slowly until after 480 hrs. the loss is very slow. The amt. of vapor retained after 480 hrs. is proportional to the time of exposure to the vapor. Absorbed hydrocarbons raised slightly the glow-point of coal, this effect increasing with the amt. of absorption.

D. A. REYNOLDS

Motor alcohol and the hygroscopicity of the air. K. PETRIK. *Z. Spiritusind.* 50, 136-7(1927).—In the motor fuel tested which consisted of a mixt. of 50% alc. of 96.5% purity, the remainder being benzene and benzine, the water in the alc. burned consisted of 15.4% of the amt. contained in the 1023 cu. m. fairly dry air necessary to effect combustion of 1 kg. of motor fuel. The necessity of using dehydrated alc. has not been clearly demonstrated.

C. N. FREY

Factors governing the purchase of coal. M. B. SMITH. *Mech. Eng.* 49, 1063-6(1927).

E. J. C.

Our (British) available coal supplies and their utilization. C. H. LANDER. *Gas J.* 179, 547-8; *Gas World* 87, 230-1; *Chemistry & Industry* 46, 843-5; *Engineering* 124, 340-1(1927).—Coal remaining in Great Britain has been estd. at 180,000 million tons, annual production, approx. 260,000,000 tons, of which some 80,000,000 tons are exported. Data on coal consumed by different industries in Great Britain during 1924 and 1925 are tabulated. Losses caused by present methods of utilization and possible improvements are discussed. Brief reviews are given of some investigations on smoke abatement, low-temp. carbonization, hydrogenation of coal, and the constitution of coal. The importance of coördinating lab. results with full unit scale expts. before passing processes to the industries is emphasized and the objectives of the Fuels Research Board are outlined.

W. W. HODGE

The utilization of our (British) coal supplies. J. W. COBB. *Gas J.* 179, 548-50; *Gas World* 87, 231-3; *Chemistry & Industry* 46, 845-8; *Engineering* 124, 341-2(1927).—The relative advantages and disadvantages of hydrogenation, gasification with steam or air, carbonization of coal and of refractory and metal retorts are outlined. The outstanding technical factor limiting the economies of carbonization seems to be that of speed of operation. Progress may be made by altering the mech. and thermal treatment of the coal and by modifying its chem. behavior and reactivity. Results of gasification expts. with cokes made from coal alone and from coal mixed with 5% of Fe₂O₃, CaO or Na₂CO₃ are tabulated and discussed. The gas yield increased 20% with a Na₂CO₃ coke and NH₃ yield, by 35% with a CaCO₃ coke. On treating with steam 10 g. samples of the different cokes heated in tubes to 1000° the comparative rates of coke gasification were: pure coke 1.15, CaO coke 5.2, Fe₂O₃ coke 10.5 and still faster for the soda coke. Rate of gasification with steam of pure coke at 800° was 0.9 with 18.0% CO₂ in the resulting gas, of soda coke the rate was 5.8 with only 1.7% CO₂ in gas produced. Cokes made with alumina and silica addns. behaved exactly like the pure coke. In expts. passing CO₂ at such a rate over the cokes at 1000° that the pure coke

gave a gas with only 47.8% CO, the Fe oxide, lime and soda cokes produced gases with 93, 95 and 97% CO content, resp.; at 900° the CO percentages were: pure coke 14%, the others in order, 70, 63 and 82%. Expts. with addns. of less than 5% of the inorg. compds. show that useful effects can be obtained thereby in a more than proportionate measure. W. W. HODGE

Cebu coals. L. A. FAUSTINO. *Philippine J. Sci.* 33, 375-9 (1927).—Eight samples from the Licos mines averaged about 10% moisture, 4.0 volatile combustible matter, 44.0 fixed C, 0.41 S and, excluding one sample, 4.5 ash. Cal., excluding the same sample as before, ranged from 6251 to 6982. Of the 7 samples from Uling mines, 5 were generally higher in moisture and ash and lower in cal. than the samples from the Licos mines. Of the 15 samples only 2 were coking coals. Contrary to expectations the quality of the coal does not improve with the depth of mining. L. W. RIGGS

The chemistry of coal. R. V. WHEELER. *Gas J.* 179, 624-7; *Gas World* 87, 233-5; *Chemistry & Industry* 46, 848-54; *Engineering* 124, 344-6 (1927); cf. *C. A.* 20, 3554; 21, 2780.—Researches on phys. structure and chem. compn. and constitution of coal are reviewed under the subdivisions: coal-forming materials; major constituents of coal; chemistry of coal ulmins, spore exines and cuticles, resins, hydrocarbons; extn. of coal by solvents: distn. of coal, effects on ulmins and on the resistant plant remains; oxidation of coal. The relation of these factors to coal formation, banded constituents, geological age, coking properties and the manuf. of oils from coal are discussed. W. W. HODGE

Colloidal chemistry of coal and related problems. H. WINTER. *Kolloid-Z.* 42, 233-42 (1927).—The formation of coal from vegetation is treated as a dehydration problem involving a change from a hydrosol to a hydrogel, finally giving an insol. gel. The nature of various samples of coal can be studied with the microscope and some photomicrographs are presented with the discussion. The macroscopic examn. of coal is described and its value is also stressed. R. H. LAMBERT

The cleaning of coal. XVI. XVII. W. R. CHAPMAN AND R. A. MOTT. *Fuel in Science and Practice* 6, 293-311, 340-58 (1927); cf. *C. A.* 21, 1175, 3262.—Froth flotation and dewatering of washed coal are discussed in detail from the theoretical as well as practical point of view. Numerous illustrations are included. D. A. R.

Separation of coals according to specific gravity. MANFRED DUNKEIL. *Mitt. Schlesischen Kohlenforsch. Kaiser-Wilhelm. Ges.* 2, 183-92 (1925); *Chem. Zentr.* 1926, II, 1707.—Instead of concd. aq. salt solns., D. utilizes in the floating method a mixt. of CCl₄ and xylene, and thus obtains fractions of different ds. which behave quite differently on coking. Anthracite and dull coal do not, however, remain within single fractions, but distributed throughout the fractions of different ds. The results show that 2 coals may be widely different even when they appear to be the same by proximate analysis. C. C. DAVIS

Low-temperature distillation of long-flame coal agglomerated by a pitch or coal oil. ANDRÉ LÉAUTÉ. *Compt. rend.* 185, 465-7 (1927).—By the use of a binder it is possible to avoid swelling and solidification of long-flame coal on distn. without the addn. of non-bituminous coal or without operating with carefully controlled heating. When anthracene oil is used as the binder a solid residue is obtained similar to anthracite and can be used as such. This method offers a means whereby a quantity of oil is obtained which is approx. equal to the amt. of binder used and a quantity of gas varying from 2 to 15% is obtained depending on the rate of distn. D. H. POWERS

New methods of coal distillation and gasification. DRAWE. *Braunkohle* 26, 573-7; *Erdöl u. Teer* 3, 614-8 (1927).—A general discussion. F. S. GRANGER

The recovery of by-products from the distillation of coal in modern coke ovens, with special reference to the still process. R. GUNDERSON. *Ind. Chemist* 3, 397-402 (1927).—The "direct" process is briefly outlined, and the "still" or "semi-direct" process is described in detail with illustrations. E. G. R. ARDAGH

The refining of brown coal gas (Schwelgas) benzine. H. TRUTNOVSKY. *Teer* 25, 363-6, 379-82 (1927).—A discussion of the effects of various standard refining methods applied to this rather difficult raw material to make it a satisfactory motor fuel, which has been accomplished commercially. The principal objectionable qualities, namely odor, resin and C formation in the engine, color and changes in storage, are due mainly to the highly unsatd. constituents (diolefins, etc.) which also include a large portion of the S compds. present. The methods are discussed under 4 headings. (1) With *sulfuric acid* the S content can not be reduced very far without excessive loss. The common com. practice is to treat with H₂SO₄, followed by lye, and distil twice. Addn. of a little paraldehyde, with the acid, removes more S and greatly improves the odor. (2) The diolefins, etc., including S compds., may be removed by polym-

erization followed by distn. This may be accomplished, with little loss, either by heating with fuller's earth, at 100°, or alone under 13.5 atm. pressure at 230°. (3) Washing with hypochlorite soln., followed by lye, removes only a small portion of the S, while relatively large quantities of Cl are taken up by the oil. The Cl and considerable S are removed in the subsequent fractionation, giving a high-grade product. The removal of S by this means depends largely on the form of the S. The S compds. remaining after refining with H₂SO₄ are so altered that a larger proportion may be removed by subsequent application of the hypochlorite method than with the raw material. (4) *Silica gel*, although effective with other materials in this respect and with this material in other respects, does not remove much of the S unless used in prohibitive quantities, and then a large portion of the benzine is absorbed which, on recovery, is inferior to the refined product. Owing to the removal of the diolefins, etc., by polymerization, however, the main product is highly satisfactory except for the S content. Contrary to earlier claims, no method has been found which will remove all of the S, but it has been found more practical to judge this product by actual performance in the engine rather than by chem. analysis. F. S. GRANGER

Technical and economic considerations on coal refining with special reference to high-pressure processes. C. KRAUCH. *Erdöl u. Teer* 3, 455-7 (1927).—A general discussion. F. S. GRANGER

The refining of coal and its liquefaction. A. SPILKER. *Braunkohle* 26, 545-53 (1927).—A general discussion. F. S. GRANGER

The chemical principles in coal liquefaction. FRIEDRICH BERGIUS. *Svensk Kem. Tids* 39, 189-208 (1927).—An address on coal chemistry in German. A. R. ROSE

Utilization by processing of low-grade coals as well as liquefaction of coals. ALOIS CZERNIAK. *Montan. Rundschau* 19, 283-90, 309-16, 337-44, 371-5 (1927).—An outline of the chem. properties of C and several series of hydrocarbons is followed by a discussion of the methods for utilizing brown coals, lump coal and lignites. Effects upon the coal, its by-products and heating values are given of: improvements in by-product oven design; drying of the coals by applying steam under pressure; the "Berfinierung" process; the carburization or "Delkeskamp" method; and the swelling processes. Descriptions of these processes, sectional diagrams of a Rolle-Oven installation and several tables of data obtained using different kinds of coals, also manuf. and uses of producer gas and "grudekok" are included. The distribution and economics of the petroleum industries are discussed from the national and world standpoints. The expts. of Bergius and of Fischer in making liquid fuels from coal are reviewed, compared and the importance of these processes to countries which do not possess petroleum fields is emphasized. A no. of references to recent articles on liquefaction are given. W. W. HODGE

Drying brown coal. HANS FLEISSNER. *Arch. Wärmewirt.* 8, 185-6; *Montan. Rundschau* 19, 317-20, 345-8, 377-82 (1927).—The coal is placed in a pressure tank and steam at 4-8 atm. admitted. When the charge has been thoroughly warmed, the steam is discharged (into another drum), and air is blown through. The dried coal does not crumble, is not hygroscopic, and does not tend to ignite. E. W. T.

The hydrogenation of brown coal with hydrogen in the presence of aqueous bicarbonate solutions. FRANZ FISCHER AND ALBERT JÄGER. *Abhandl. Kenntnis Kohle* 7, 141-3 (1925); *Chem. Zentr.* 1926, II, 1915.—The use of aq. NaHCO₃ in the presence of H under pressure for the hydrogenation of coal is undoubtedly superior to HCO₂Na or to CO + H₂O, even though these latter have already attained success. C. C. DAVIS

Studies in carbonization. I. Influence of size of coal. ARTHUR SMITHELLS, A. PARKER, H. KERR AND A. C. MONKHOUSE, et al. *Inst. Gas Eng.* 16th Rept., 162-229 (1926).—A discussion of the many factors involved in coal carbonization and of requirements for a lab. app. suitable for the study of these factors is followed by a complete description including elevation diagrams and detail drawings of the exptl. plant used. A cronite (Ni-Cr-Fe-W) retort capable of handling 30 lb. charges of coal was placed in a fire brick furnace setting. A Nottinghamshire moderate caking coal was used after sizing into 6 grades: 1 1/4 to 3/4 in., 3/4 to 1/2 in., 1/2 to 1/4 in., 1/4 in. to 10 mesh, 10 to 30 mesh, and all through 30 mesh. The volatile matter was led through a series of scrubbers and meters to a gas holder. Details of operation of plant, methods of sampling and analysis of the coal, cokes, liquors, tars, pitch, crude and purified gas, and of measurement of temps. and pressures are given. Six preliminary tests were run to develop proper working conditions. Results are summarized in 5 sets of graphs and 21 tables including calcd. wt., heat, and C balances for 8 complete tests. Coking time was 2 3/4 hrs. for 5 and 2 hrs. for 3 of the tests. Temps. of the retort

ranged from about 940° to 1000°. The method (C. A. 19, 3011) for prepg. sections of coke by filling the open pores with plaster of Paris and magnesia, polishing and taking photographs is fully outlined and 43 photographs are given of sections of by-products and beehive cokes, of cokes formed in the 8 tests reported and of cokes made by carbonizing coals mixed with 5% of CaO, Fe₂O₃ or Na₂O. The cronite retort after having been heated to about 1000° for a total of over 2000 hrs. did not show any signs of deterioration. The supply of heat to the retort setting was the same in all 8 tests. Gas made in therms (gross) per ton coal rose from 72.3 with grade 1 1/4 to 3/4 in. to 75.8 therms with grade 10 to 30 mesh. This increase in total thermal values of gas made with decreasing the size of coal particles appears to be due largely to an increase in the amt. of secondary decompn. of tar, there being a gradual reduction in tar yield from 8.3 to 6.2 gals. per ton coal. In the early stages of carbonization the rates of gas production were greater with the larger sizes of coal than with the smaller sizes, but after 1 hr. the rate of gas production became greater with the smaller sizes and at the end of the 2 3/4 hr. period the total vols of gas evolved from the smaller grades of coal were greater than those from the larger grades. Raising the temp. of the retort from 977° to 1000° produced in the early stages of carbonization a great increase in the rate of gas evolution and showed the importance of accurate temp. control. Macro- and micro-studies of the coke sections polished in plaster showed the coke produced from the 10-30 mesh coal was more uniform in structure than the cokes from the larger sizes and that the walls of the larger cells contained a greater no. of very small pores. Discussions of the report by members of the society are appended.

W. W. HODGE

The economics of coal carbonization in the United States. GEO. A. ORRICK. *Mech. Eng.* 49, 1055-60 (1927).

E. J. C.

Low-temperature carbonization of coal. KARL D'HUART. *Chaleur et industrie* 8, 512-4 (1927).—Brief description of the K. S. G. Stinnes process, which has been in com. operation for a no. of yrs. at the Mathias Stinnes mines, Kariap (Essen).

A. PAPINEAU-COUTURE

Experiments on the valuation of coal dust. FRANZ FISCHER and WALTER KRONIG. *Abhandl. Kenntnis Kohle* 7, 156-63 (1925); *Chem. Zentr.* 1926, II, 1483.—The expts do not lead to a satisfactory method for the valuation of coal dust, but show rather that a method of valuation can be developed only by a scheme of expts. which are as closely related as possible to large-scale conditions.

C. C. DAVIS

The expedient utilization of the tarry constituents of the coal set free in the complete gasification of coal in the coal-water-gas producer. GWOSDZ. *Erdöl u. Teer* 3, 503-5, 518-21 (1927).—A general discussion of existing processes.

F. S. GRANGER

Burning Mid-Western coals. E. L. McDONALD. *Mech. Eng.* 49, 1082-4 (1927).—A discussion of steam coals mined in Iowa, Missouri, Kansas, Arkansas, Oklahoma and Illinois. Characteristics of the coal fields and the methods of mining are touched upon and analyses of the coals from these fields are tabulated. Results of the use of Mid-Western coals in a forced-draft chain-grate stoker unit at the Northeast station of the Kansas City Power & Light Co., Kansas City, Mo. are given. The chain-grate stoker permits control of the air supplied to any portion of the fuel bed and this is advantageous as well where the fusion temp. of the ash is so low (980-1205°). Characteristics of buffing, and slagging tendencies are discussed. The use of preheated air is desirable, as is shown by a curve. A comparison of efficiencies of boiler burning 5 Mid-West coals is charted. Any of the coals from these fields may be burned, if properly handled in the proper equipment.

W. H. BOYNTON

The Lancashire coalfield, the Ravine seam. II. Carbonization in continuous vertical retorts. R. T. THRELFALL, et al. *Dept. Sci. Ind. Research, Brit. Repts., Fuel Research No. 9*, 33 pp. (1927).—Large-scale tests were made in continuous vertical retorts with Ravine seam bituminous coal to det. its suitability for gas manuf. using coal alone, coal plus 5% steam, and with 20% steam. Complete data are presented as to the source of coal, characteristics of the seam, phys. and chem. properties of the coal, ash, gas, NH₃ liquor, tar and coke used and produced in the tests. Work wt. balances of materials entering and leaving the system show losses of 3.60% using 5% steam (some leakage through retort walls in this test) and 3.49% with 20% steam. The general effects of using 20% steam as compared with 5% steam were: increases of 37.5% in cu. ft. gas, 23.4% in therms, 1.1% of tar, and 25.5% in (NH₄)₂SO₄ yield per ton coal; and a decrease of 10.2% in B. t. u. per cu. ft. gas. Similar data are tabulated for this and other coals when carbonized alone and when using 20% steam. Thermal balances for the tests, a section drawing of the Ravine seam, and elevation and section diagrams of the continuous high-temp. retort installation at H. M. Fuel Research

Station are given. Coal from the Ravine seam proved to be well suited for gas making. Additional expts. showed: this coal and the coke produced in the gas manuf. tests could be burned efficiently for generating steam, but the low m. p. ash was a disadvantage; the coke made a satisfactory producer gas fuel, but attacked the furnace lining considerably; excessive clinker formation resulted when this coke was used for suction-gas production. W. W. HODGE

The recovery of ammonia and sulfur from coal gas by the Burkheiser process. W. BURKHEISER. *Gas u. Wasserfach* 70, 943-5(1927); cf. *C. A.* 21, 1880.—The direct union of SO_2 and NH_3 to form $(\text{NH}_4)_2\text{SO}_4$ is discussed. Complete freedom from H_2S is required in the gas; this can be best accomplished by liquid purification methods. $(\text{NH}_4)_2\text{SO}_4$ is oxidized to $(\text{NH}_4)_2\text{SO}_4$ almost quantitatively on standing in the air for a period of 2 days (in favorable cases) or sometimes as long as 6 weeks. No loss of NH_3 was observed in the latter period. R. W. RYAN

Light oils from Utah coal. R. L. BROWN AND R. B. COOPER. *Power Plant Eng.* 31, 1044(1927).—Mesa Verde coal was heated to a max. of 725° by means of superheated steam. A yield of 7 cc. per kg. of coal was obtained consisting of 30% amylenes, 10% pentane, 26% oil made up of a 6 C-atom compd., 17% oil made up of a 7 C-atom compd., 8% oil of an 8 C-atom compd., and 9% oil boiling from 125 to 200° .

The decomposition of vegetable matter under soils containing calcium and sodium as replaceable bases. E. MCKENZIE TAYLOR. *Fuel in Science Practice* 6, 359-67 (1927).—Various constituents of peat undergo bacterial decompn. under alk. anaerobic conditions produced by a superimposed layer contg. sodium-alumino-silicic complex. Sugar and starch form entirely gaseous products. Cellulose may form humic substances, sol. in the alkali present and which are later completely decompd. Under these same conditions beech leaves decomp. yielding a substance closely resembling fusain in structure and compn. Conclusion: The occurrence of natural fusain in peat under an alk. roof is best explained by the decompn. of ligneous materials under alk. anaerobic conditions provided by the hydrolyzing of the roof complex. D. A. REYNOLDS

Determination and guarantee of heating value. L. NIEDERSTRASSER. *Arch. Warmewirt.* 8, 171-4(1927).—A discussion of the effect of various errors in coal sampling and calorimetry, and of the means of securing agreement between buyer and seller.

Testing of furnaces with recorders and photography. KARL BOLLINGER. *Arch. Warmewirt.* 8, 143-4(1927).—Good firing produces a bright flame, so in the app. described a piece of sensitive paper passes slowly by a slit illuminated by the flame, and is afterward developed. ERNEST W. THIELE

Energy consumption of powdered coal mills. P. ROSIN AND E. SCHULZ. *Arch. Warmewirt.* 8, 69-73, 109-15(1927).—The effect of moisture in the feed, rate of feed, and fineness of grinding on the energy consumption of a ring-roller mill with air sepn. was studied. The energy consumed per kg. of product, over that required at no load, is a const. for a given fineness and moisture content, but the fineness tends to decrease at light loads. ERNEST W. THIELE

Energy consumption of powdered coal mills. P. ROSIN AND E. RAMMLER. *Arch. Warmewirt.* 8, 239-43(1927); cf. preceding abstr.—A Fuller mill was studied. The advantages of full load were greater than with the ring-roller mill, but the fineness did not fall off with decreasing load. ERNEST W. THIELE

The calculation of powdered coal furnaces. WILHELM GUMZ. *Feuerungstech.* 15, 157-60, 172-4, 184-6, 197-9(1927).—A full discussion, deriving several formulas and applying them to a particular example. ERNEST W. THIELE

Furnace for heating shapes with powdered coal. A. FARNER. *Arch. Warmewirt.* 8, 94-5(1927).—An Italian furnace 10.5 m. long, heated with 4 burners, is described. ERNEST W. THIELE

Efficiency of furnaces, especially for powdered coal. A. B. HELBIG. *Feuerungstech.* 15, 193-7(1927).—Since the dry ash-free coal substance is nearly const. in compn. for a given type, H. proposes to prep. tables of heat content of flue gases, etc., based on 1 kg. of pure coal, to facilitate the prepn. of heat balances. E. W. T.

Coal drying for powdered coal furnaces. H. BLEIBTREU. *Arch. Warmewirt.* 8, 81-7(1927).—A mathematical discussion of the various types of driers. E. W. T.

Pulverized coal installation saves \$6300 in six months. B. H. ROBERTS. *Power* 66, 540-1(1927).—Unit pulverizers replaced oil firing. The efficiency of the boiler plant was 75%. D. B. DILL

Economy of lignite-dust firing. P. ROSIN. *Braunkohle* 26, 364-89(1927).—An

elaborate general statistical discussion from the engineering and economic standpoint.

F. S. GRANGER

Recent investigations of the mechanism of ignition and combustion in Diesel engines. FR. SASS. *Z. Ver. deut. Ing.* 71, 1287-92(1917).—A review of the literature of the past few years.

GEORGE CALINGAERT

The significance of lignite benzene for internal-combustion engines and its relation to the lubricating oils. FR. FRANK. *Braunkohle* 26, 553-8(1927).—Until recently lignite benzene has been in disfavor as an automotive fuel because of its odor, unsatisfactory performance and impurity causing carbonization and sticking of valves. A greatly improved product, however, is now being produced as shown by practical running tests and chem. investigation. The new material evaps. completely in 24 hrs. by the Dietrich method, leaving no resin and is rich in aromatics, resulting in high anti-knock value even when mixed with inferior gasoline, as shown by practical tests. The results in regard to carbonization, etc., it is to be inferred from the exhibition of engine parts and photographs, were highly encouraging, although details are lacking in the text. Mention is made of a refining method being developed by F. involving the sepn. of the aromatic and paraffin constituents by selective soln. in hydroxyl compds. A partial sepn. of the S compds. seems also to have been effected.

F. S. G.

Smoke abatement methods used in Cleveland. E. H. WHITLOCK. *Mech. Eng.* 49, 1071-5(1927).—The importance of clear definition in municipal ordinances on smoke abatement is noted. Correct design of combustion equipment, the use of accurate control instruments, and the importance of education are pointed out. Recently a "soot-fall test" has been established which permits detn. of the total deposit at various stations throughout the city, and analysis is made of the deposit for: ether ext., fixed C, ash, and Fe_2O_3 . Railroads and marine shipping interests are cooperating.

W. H. BOYNTON

Production and purification of benzene by means of silica gel and other adsorptive substances. A. THAU. *Glückauf* 62, 1049-56; *Chem. Zentr.* 1926, II, 1914.—After mentioning the disadvantages of the Brunck process for adsorbing heavy hydrocarbons such as C_6H_6 from coal gases by tar wash oil, and after then discussing the difficulties of the Bunte activated C process, the SiO_2 -gel process is discussed and the plant of the "Silica Gel Corp." of Baltimore for the adsorption and purification of C_6H_6 , the quality of the products obtained and the economy are described in detail and criticized. The establishment of plants in Germany for the SiO_2 gel process is also discussed (cf. Koetschau, *C. A.* 20, 1476).

C. C. DAVIS

Production of benzene through distillation in vacuo. R. KATTWINKEL. *Glückauf* 62, 529-34; *Chem. Zentr.* 1926, II, 303.—The expts. of Bahr and Rühl (*C. A.* 19, 3581) are criticized, particularly the use of unsuitable wash oil. From expts. of his own, K. concludes that the vacuum distn. process of Raschig possesses fundamental advantages over the older steam distn. process. It furnishes a highly valuable product free of wash oil and it requires only 0.5 as much steam and fresh oil as the old process.

C. C. DAVIS

The ideal efficiency of internal-combustion engines. W. T. DAVID. *Gas J.* 179, 695-6(1927).—Sp. heat and dissocn. values ordinarily used in calcg. the ideal possible efficiencies of internal-combustion engines are too high and consequently ideal efficiencies are too low. Expts. have been made with pure gases (mainly CO and H_2 mixts.) by optical indicating and flame photography. On explosion, chem. equil. is far from being attained at max. pressure, contrary to the usual assumption of complete combustion used in calcg. sp. heats.

R. W. RYAN

The economics of scientific control in the production of town's gas. E. W. SMITH. *Gas J.* 179, 616-8(1927).—Some applications of science to the gas industry are given and a plea is made for more financial support for research and for a more scientific attitude of mind towards all gas works problems.

R. W. RYAN

The new gas works at Stettin. SPOHN. *Gas u. Wasserfach* 70, 893-8, 925-6(1927).—A detailed description is given of the new "Stettin" vertical oven plant. A feature of this plant is the absence of belts and conveyors and the compact arrangement.

R. W. RYAN

Gas blending. ROBERT STURROCK. *Gas J.* 179, 621-4; *Gas World* 87, 256-60(1927).—Blue gas from "Simplex" water gas plant is used to reduce gas from horizontal retorts to 439 B. t. u. per cu. ft. On the Simplex plant a 6 min. blow and 20 min. run period are used, which decrease labor charges. Analyses are given for the blue gas at various run times.

R. W. RYAN

The economic and technical significance of fuel waste gas quantities. BR. SCHULZ. *Brennstoff u. Warmewirtschaft* 9, 377-80(1927).—A discussion.

F. S. GRANGER

Sealing fluids for technical gas investigations. OTTO WOLF AND KRAUSE. *Arch. Wärmewirt.* 8, 216-8(1927).—The soly. of CO_2 at 20° in water and NaCl and CaCl_2 brine was tested with a Bunte buret. Acidulation with H_2SO_4 or HCl is useless or harmful, except for alk. water. Nearly satd. NaCl brine is recommended; it reduces the soly. to 30% of that in pure water.

Automatic gas analysis by physical means. OTTO DOMMER. *Arch. Wärmewirt.* 8, 92-3(1927).—Two streams, one of flue gas and one of air, are drawn by the same aspirator through a capillary tube and an orifice in series. The difference in pressure drop through the 2 capillaries (arising from the difference in gas viscosities) is measured by a U-gage and is proportional to the CO_2 content of the flue gas. With a CuO furnace, CO also can be detd.

Testers and counters for flue gas. WERNER AHRENS. *Arch. Wärmewirt.* 8, 183-5(1927).—An integrator for a CO_2 or CO recorder is formed by causing the indicating current to decompose water in a simple rugged cell. The H_2 evolved is collected and read off.

Removal of carbon monoxide from illuminating gas by means of ammoniacal cuprous chloride solution. W. GLUUD AND G. SCHNEIDER. *Ber. ges. Kohlentech.* 2, 51-3; *Chem. Zentr.* 1926, II, 2516-7; cf. *C. A.* 21, 4053.—The soln. consisted of 213 g. of NH_4Cl , 172 g. CuCl and 360 cc. of concd. NH_4OH (19.4% NH_3) according to Wollers. The gas contained 2.4% CO_2 , 2.0% C_mH_n , 1.6% O and 9.8% CO . The expt. was carried out at 15° . According to the Hempel procedure, with absorption of 6 vols. the soln. (2.7 l.) was exhausted after 165 l. had been passed through it. Actually, however, it sufficed for about 400 l. of gas passed through at the rate of 800 l. per hr. at 60 atm. pressure. The issuing gas then contained about 0.6% CO . The absorption soln. deposited metallic Cu . Hot 20% NaOH absorbed 280 l. of CO , the CuCl soln. only 30-40 l. of CO per 2.7 l. of soln.

A new method of titrating naphthalene in gases. J. BONTE. *Bull. soc. chim. Belg.* 36, 485-90(1927).—The principle of the method is to cool the gases down to 0° . At this temp. the vapor tension of the naphthalene is practically naught. The naphthalene is collected on a wool glass filter, then dissolved in a known amt. of glacial AcOH . H_2O is added from a buret, and the reading is made when the naphthalene comes out of soln. By means of a curve previously drawn, the amt. of naphthalene can be deduced from the quantity of water added, and is converted in g. of naphthalene per cu. m. of gas.

A by-product producer gas plant at a copper works. ANON. *Engineer* 144, 234-5(1927).—This plant, at an isolated mine in Northern Rhodesia, meets the following requirements: power for driving machinery; heat for reduction and treatment of ores; NH_3 for leaching out CuO from the ores; tar of a quality suitable for readily reducing the oxide in the smelting furnaces, for painting and for road-making purposes. The arrangement of the plant is described and illustrated.

Modern gas producers. F. RICOLFI. *Met. italiana* 18, 197-204(1926).—A description, with sketches and photographs of 2 types of gas producers, (1) the coke gas producer with automatic scorification, (2) the gas producer on the Tully system.

Rational systems of combustion. F. RICOLFI. *Met. italiana* 18, 113-21(1926).—Description of a modern automatic system of combustion. Phot. graphs and sketches are given.

Luminous and non-luminous flames in industrial gas furnaces. KARL HUFFELMANN. *Feuerungstech.* 15, 145-6, 160-3, 174-6, 186-7(1927).—H. gives an elaborate calcn. of the heat transfer in an open-hearth furnace, assuming various flame lengths, degrees of luminosity, types of fuel, and degrees of preheating.

Physics of the oxide radiator—especially the Welsbach mantle. H. EWEST. *Gas u. Wasserfach* 70, 873-7(1927).—The phys. theory underlying the oxide radiator is reviewed. The spectral distribution of the radiation from the Welsbach mantle and of mixts. of ThO with La , Ni , Er , Pr and Nd oxides is shown graphically for various temps.

A tar obtained from lignite by steam distillation. I. Comparative experiments on the distillation of lignite by external and internal (superheated steam) heating. W. FISCHER. *Braunkohle* 26, 246-51(1927).—The lab. app., in which the lignite was distd. with superheated steam, is described. The duration of the distn. was 18 hrs. By this means complete removal of the tar can be accomplished with very little decompn. of original bitumen, and the liberation of 54.8 l. of gas, per kg. of dry coal, as against 108 l. by external heating. In the steam distn. the gas evolution rate began to increase rapidly at 400° , reaching a max. at about 436° (when no more tar

came over) and then falling off rapidly to the end of the distn. at 460°. The coal yielded 32% dry distillate and 47% coke, with steam, against 25 and 50% by external heating. The steam coke yielded 49.4 l. of gas per kg. on heating at red heat, whereas the other yielded only 24 l. The steam tar contained higher-boiling acid and neutral constituents and neutral oil of higher sp. gr. and S content. F. S. G.

Viscosity of tar. J. LAGERQVIST. *Svensk Kem. Tids.* 39, 97-100(1927); cf. C. A. 21, 2551.—The Engler unit of viscosity (E) is 26 times that obtained by the Lunge-Berl method. Viscosity may be detd. as the time (t) in seconds for a given vol. of the sample (200 cc.) to flow through a tube of a given bore (6 mm.). For 3 of the latter procedures the values are translated to Engler units as follows: $E = 0.442(t_4 - 5)$ and $E = 0.216(t_5 - 5)$ for 200 cc. and 5- and 6-mm. tubes, resp. When the vol. is taken as 100 cc. (6 mm.) the following holds for all samples with E in excess of 180, $t_{200}/t_{100} = 2.35$ and $E = 1.0157t_{100} - 2/(1 - 0.0000038t_{100})$. A. R. ROSE

Variation of the Hutchinson consistency of tars with temperature. H. M. SPIERS. *J. Soc. Chem. Ind.* 46, 329-30T(1927); cf. C. A. 21, 485.—Contrary to Mallison and Soltau (*Brennstoff-Chem.* 8, 169(1927)) the relationship $C_1/C_2 = K(T_2 - T_1)$, connecting the temp. and consistency of tar, is true within the limits of exptl. error over ranges of temp. as large as 10°, as shown by examn. of the figures given by M. and S. The value of K changes abruptly at certain temps. depending on the nature of the tar, and such changes probably indicate a sudden alteration in the phys. properties of the tar. The temp. interval is large enough to satisfy the requirements of works tests, which are generally carried out to enable faulty batches to be corrected or to make adjustments to the still. In such a case, even if there is a transition pt. between the 2 temps. at which the tar is tested, the value calcd. for the consistency at standard temp. will be sufficiently close for the purpose. A. PAPINEAU-COUTURE

Investigation of the steam-volatile neutral oil of generator tar. ERWIN KARY. *Braunkohle* 26, 577-83(1927).—Lignite generator tar was distd. with steam at 100°. The neutral oil, from this distillate, redistilled in vacuum, was investigated as follows. The portion which could be pptd. by an acidified ferrocyanide soln. increased on long standing and this was attributed to "auto-oxidation" of unsatd. constituents. The oil recovered from the ferrocyanide addn. products had 2-4 times the O content of the original neutral oil and yielded a semicarbazone, $C_8H_{13}ON_2$, corresponding to an unknown ketone, $C_7H_{14}O$, probably the "auto-oxidation" product of one of the hydroaromatic hydrocarbons, whose presence in the neutral oil was indicated by the reaction with mercuric acetate. Aliphatic olefins could be demonstrated only in small quantities. One fraction of the neutral oil was sepd., by treatment with a little methanol, into an immiscible (raffinat) and a miscible (ext.) portion. The "extract" was entirely oxidized by mercuric acetate, indicating that it contained no appreciable quantity of paraffins. F. S. GRANGER

Removal and recovery of tar acids from ammonia still effluent by means of activated carbon. ROBINSON BROS. *Gas J.* 179, 546(1927).—The liquor is acidified with CO_2 or other acid until acid to litmus and allowed to settle and then run through a series of adsorbers contg. activated C. The adsorbers are cut out in turn, freed from phenols by steam distn. and then returned to the circuit. In 6 runs an efficiency of removal of phenols of over 95% was obtained. A new activated C has been developed which is more active towards phenols than any other examd. R. W. RYAN

Decolorization and deodorization of phenols extracted from lignite oils. A. MAILHE. *Bull. soc. chim.* [4], 41, 1062-4(1927).—See C. A. 21, 1880. A. P.-C.

Researches on the reduction capacity of coke. G. AGDE AND H. SCHMITT. *Z. angew. Chem.* 40, 1003-8 1027-32(1927).—Previous work on this subject is critically reviewed. A lengthy bibliography is given and methods used are classified into qual., quant., and technical. To det. the factors involved in the reducing abilities of cokes expts. were carried out by heating various cokes such as a model coke made from nearly ash-free soot and pitch; pitch and graphite, pitch coke, and some com. cokes in a tube through which dry CO_2 was passed. Data were taken on the rate of flow of gas, analyses of effluent gases, temp. of tube, size and condition of coke particles, and duration of run. Two diagrams illustrate the description of app. used. Temps. varied from 600° to 1000°. Results are summarized in 8 tables and 11 sets of curves, some showing the progress of reduction. The differences in reduction capacities of cokes appear to be due as much to their actual chem. compn. as to the condition of the surfaces of the cokes. W. W. HODGE

Experiments on the combustibility and the strength of metallurgical coke with a coarse grain. II. F. HAUSER AND R. BESTEHORN. *Ber. Ges. Kohlentech.* (Dortmund-Eving) 1926, 457-88; *Chem. Zentr.* 1926, II, 2249.—Continuing and extending

earlier expts. (*Ber. Ges. Kohlentechn.* (Dortmund-Eving) 1925, 345; cf. *C. A.* 20, 982), the present work deals with the influence of various oven temps., chamber dimensions, type of coal used for coking, grain structure of the coal, addns. to the coal, method of quenching and crushing of the coal on the combustibility and on the strength of the resulting coke. The results show that the finer the grain of the coke the better are the combustibility and the strength of the coke. Grinding of the coal also leads to a better blending of the different components. Compared with careful hand quenching, dry cooling of the coke gave less small coal, whereas the combustibility and strength of the wet quenched coke were slightly superior. The S contents were the same; that of the dry cooled coke was somewhat more difficult to ignite. The combustibility of coke was hardly changed by crushing the coal, while the strength of the coke was increased by this treatment.

C. C. DAVIS

New ideas in coking and gasification. DRAWE. *Gas u. Wasserfach* 70, 904-5 (1927).—Coal dried with flue gas had a tendency to go through the boiler grates. This was remedied by maintaining a deeper fuel bed. In coking lignite in a rotating retort, the escape of gases and uniform coking were facilitated by the use of an angle iron plow which furnished a channel for the escape of gases. The use of O in gas producers is discussed. The price of O is the controlling factor. Gas of higher calorific value undiluted by N can be secured even from lignite. Analyses and cost data are given.

R. W. RYAN

The production of gas from lignite semi-coke. M. DOLCH. *Braunkohle* 26, 301 11(1927).—For the purpose of studying the merits of proposed finishing or degassing processes for semi-coke, specimens of 4 different commercial lignite semi-cokes were analyzed and investigated similarly with reference to gas yield, heat units in gas per ton of coke, % of the original heat value of the coke obtained in the gas, and gas compn. Sets of curves are given in which these, resp., are plotted against finishing temps. The results are analyzed and discussed at length with reference to economic efficiency. The lowering of the value of the residual coke, due to loss of fuel value, increased ash content and alteration of structure is an important consideration. The general conclusion is unfavorable to the future of the process.

F. S. GRANGER

The removal of carbon monoxide from coke-oven gas. W. GLUUD AND G. SCHNEIDER. *Ber. ges. Kohlentechn.* 2, 30-50; *Chem. Zentr.* 1926, II, 2516.—Processes for the removal of CO according to the reaction: $\text{CO} + \text{H}_2\text{O} \rightarrow \text{CO}_2 + \text{H}$, through absorption in $\text{CuCl}_2\text{-NH}_3$ soln., or in $(\text{HCOO})_2\text{Cu}$ soln., are not suited to the removal of CO from compressed coke-oven gas. The Berthelot process which utilizes the reaction: $\text{NaOH} + \text{CO} \rightarrow \text{HCOONa}$ (cf. *Ann.* 97, 125(1856); *German Patent* 212,844) was more closely examd. The process of Fa. Köpp & Co. (*German Patents* 209,417 and 212,641) was found the most satisfactory in operation, CO being washed out with dil. NaOH or Na_2CO_3 until it could no longer be detected analytically. The NaOH is completely transformed into HCOONa, but absorption of the remaining part continues for a prolonged period if the gas is treated with a counter-current of hot aq. NaOH. Essentially more favorable was the result when the gas was passed through the liquid at 230° under 60 atm. pressure. Under these conditions it was found unexpectedly that the CO_2 content of the washed gases increased when the soln. was satd. with CO. A sep. expt. showed that HCOONa and NaOH reacted partially according to the equation: $3\text{HCOONa} + \text{NaOH} \rightarrow 2\text{Na}_2\text{CO}_3 + \text{MeOH}$. Still on treatment of HCOONa with illuminating gas at 230° and 60 atm. the reactions: $2\text{HCOONa} \rightarrow \text{Na}_2\text{CO}_3 + \text{CO} + \text{H}_2$ and $\text{Na}_2\text{CO}_3 + 2\text{CO} + \text{H}_2\text{O} \rightarrow 2\text{HCOONa} + \text{CO}_2$ might take place, and in the presence of hot HCOONa the reaction: $\text{CO} + \text{H}_2\text{O} \rightarrow \text{CO}_2 + \text{H}_2$. When CO_2 humidified to 80% and CO_2 -free was passed through fused HCOOK at 280°, large quantities of CO_2 were evolved. At higher temps. the CO_2 content became negligible, while the H content increased from 6% at 280° to 16.1% at 350°.

C. C. DAVIS

The causes of the difficult inflammability of dry quenched coke. W. MELZER AND F. BACKENKÖHLER. *Ber. ges. Kohlentechn.* (Dortmund-Eving) 1926, 489-98; *Chem. Zentr.* 1926, II, 2249.—The d., kindling point (by the method of Bunte and Kölmel) and porosity and surface condition of various kinds of coke were investigated, each kind being sepd. into 3 layers for examn.: (1) the cauliflower-like outer layer; (2) the center section, and (3) the tar seam. Each kind of coke was examd. after quenching wet, dry (by inert gases), with solid CO_2 and with coned. NH_4OH . The outer layers of each sample showed higher kindling points than the inner, and the dry quenched cokes showed higher kindling points than the wet quenched ones, those quenched with CO_2 and with NH_3 showing intermediate values. Conclusion: The kindling temp. is influenced by the temp. of the quenching agent, by the time consumed in the quenching operation and by the particular quenching agent. During

quenching, steam enters the pores of the coke, and this influences the kindling point. By agitating the incandescent coke, the steam is decomposed and the liberated O oxidizes either the difficultly inflammable C modification on the surface of the coke or activates the surface (from the point of view suggested by Ruff). If this conception is in agreement with the actual phenomena, coke which has been quenched without the use of agents which liberate O must kindle with more difficulty than wet quenched coke of the same origin. This was shown to be true by the fact that the kindling point and surface structure of coke quenched with NH_4OH was intermediate between wet and dry quenched coke and that the properties of coke quenched with CO_2 were similar to those of dry quenched coke.

C. C. DAVIS

Recovery of waste heat from coke by dry quenching. ANON. *Power* 66, 404-5 (1927).—The coke is cooled by a continuous current of flue gases which then pass through a specially designed waste-heat boiler.

D. B. DILL

Apparatus for the dry quenching of coke, and plant for sorting coke at the Langenthal gas works. FRITZ AEBERHARD. *Monats.-Bull. Schweiz. Ver. Gas- u. Wasserfach.* 6, 167-73; *Chem. Zentr.* 1926, II, 1355.—A detailed description of the plant for the dry quenching of incandescent coke by means of the direct transference of heat to water in double-walled receptacles, for grading coke into sizes and for the mech. discharge of coal. Operating data are included.

C. C. DAVIS

The specific heat of lignite and lignite semicoke. KARL D'HUART. *Braunkohle* 26, 341-5 (1927).—A general review of existing data with the following conclusions. The av. sp. heat of dry lignite, between 0° and 100° , is about 0.25. The effect of the ash content is negligible and that of the moisture additive. The sp. heat of semicoke of known compn. can be calcd. additively from the sp. heats of graphite, quartz, water and the other volatile constituents.

F. S. GRANGER

Calculations, principles and the economy of the conversion of ethylene present in coke-oven gas into alcohol. W. GLUUD AND G. SCHNEIDER. *Ber. ges. Kohlentechn.* 2, 5-22; *Chem. Zentr.* 1926, II, 2516.—The calcn. is based on the treatment of 120,000 cu. m. of crude gas per day. It showed, with a plant investment of 200,000 marks, a charge of about 20.1 pfennigs per kg. of 90% EtOH , and with an investment of 100,000 marks, about 17.3 pfennigs. The calcn. of the costs was carefully carried out, and was based on lab. expts. on the chief washing process, assuming about 80% satn. of the acid. The process of Tropsch and Dittrich (cf. *C. A.* 19, 2793) offers no advantages.

C. C. DAVIS

Iron minerals utilized in high coke furnaces in Italy. GIUSEPPE TOMARCHIO. *Met. italiana* 18, 294-307 (1926).—Monograph on the practices and analytical methods used in connection with certain Italian coke furnaces. The following topics are taken up: sampling, detns. of moisture, SiO_2 , Fe, Mn, Al, CaO, MgO, P, S and loss on ignition. A list of the domestic and foreign minerals used is given, together with tables of their compn.

ROBERT S. POSMONTIER

Test of the capacity of a coke-producer plant at the Berlin-Neukölln gas plant. F. PLENZ. *Feuerungstech.* 15, 232-4 (1927).—The producer had water-cooled walls. Many details of the 7 tests are given; the av. thermal efficiency was 87%, the cold gas efficiency 80%.

ERNEST W. THIELE

Modern coking and by-product installations in Germany, Belgium, Holland and France. ANON. *Gas World* 87, No. 2252, Coking and By-Product Section, 13-32 (1927).—A description of modern coke-oven and by-products installations visited by the British Coke Oven Managers Association in Europe.

R. W. RYAN

The historical development of the design of the by-product coke oven. R. A. MOTT. *Fuel in Science and Practice* 6, 373-80 (1927).—An illustrated review.

D. A. REYNOLDS

Asphalt and tar (SCHLÄFFER) 22. The formation of CH_2O from water gas in the electric glow discharge (KOENIG, WEINIG) 4. Production of illuminating gas from the Stuttgart sewage filter plant (SOHLER) 14. The influence of CH_4 on the synthesis of NH_3 (SCHÖNFELDER) 18. Ignition of natural gas-air mixtures by heated metal bars (COWARD, GUEST) 2. Is the production of water-free motor fuel a luxury or a necessity? (FRITZWEILER) 16. The electrical conductivity of vapors and liquid drops during incipient combustion (BENNETT) 2. Ionization in flames of various organic substances (BENNETT) 3. Electrolysis of mains by stray currents (SARRADE) 4. Aromatic and hydroaromatic compounds of lignite tar (HERZENBERG, RUHEMANN) 10. Bituminous emulsion for use in briquets (U. S. pat. 1,643,675) 22. Concentrating apparatus for coal (U. S. pat. 1,644,112-3) 1. Device for introducing or discharging materials to or from reaction vessels operating under high pressures (Brit. pat. 262,901) 1.

Motor fuel. S. P. MARLEY and WM. A. GRUSE. U. S. 1,645,109, Oct. 11. Volatile petroleum products such as gasoline are mixed with phenetidine, anisidine or other suitable alkoxy deriv. of an aromatic amino compd., in order to restrain knocking.

Controlling fuel combustion in furnaces. J. W. GRISWOLD. U. S. 1,644,123, Oct. 4. A portion of exhaust products of combustion is withdrawn from the furnace, mixed with air, and combustible constituents in the gases withdrawn are burned; the supply of combustion-supporting gases to the furnace is controlled by differences in temp. of the exhaust gases before and after combustion of their residual combustible constituents, so as to maintain a min. of combustible material in the exhaust gases. An app. is described. Cf. C. A. 20, 2407.

Fuel briquets. H. F. LEISSNER. Swed. 63,512, Aug. 16, 1927. Straw and similar materials are pressed into briquets by applying a high pressure at a temp. sufficiently high to secure an efficient binding. The temp. should not be so high that carburization will commence.

Utilizing bituminous alum slate and other fuels with high ash content. S. V. BERGH. Swed. 63,296, July 12, 1927. Mech. features of crushing and sorting for obtaining the highest possible output.

Ammonia and organic acids by destructive heating of peat. G. H. HELLSING and O. L. CHRISTENSON. Swed. 62,811, April 19, 1927. The gaseous products from the retorts or producers are condensed in two or more steps. In the first step are condensed all the org. acids and the NH_4 salts of such acids, the tar substances and at least sufficient water for keeping the acids and salts in soln. In the second step are condensed the remaining amt. of ammonia and tar and more water. The temp. and absorption conditions in the first step are regulated by returning into the absorption app. a suitable amt. of the condensate after it has been heated or cooled to the desired temp. The solns. are worked separately for ammonia and org. acids.

Apparatus for drying, degasifying, gasifying or hydrogenating coal, etc. J. TRAUTMANN. Brit. 262,791, Dec. 8, 1925.

Producer gas. H. NIELSEN and B. LAING. Brit. 262,834, June 20, 1925. Producer gas rich in CO is made by passing CO_2 through a retort contg. semi-coke at a temp. of 750–850°. The semi-coke is obtained by distn. at 400–800°. An app. is described.

Enriching producer gas with a high water content. C. P. FISKE and A. BYSTRÖM. Swed. 61,857, Nov. 2, 1926. Gas produced from fuels contg. much H_2O , such as saw mill waste, peat, etc., are enriched by addn. of oil at a point before the regenerator and under such conditions that the H_2O vapor will react with the oil under the influence of the high temp. in the regenerator forming combustible gases.

Coke oven. W. H. WRIGHT. U. S. 1,643,532, Sept. 27.

22—PETROLEUM, LUBRICANTS, ASPHALT AND WOOD PRODUCTS

F. M. ROGERS

The petroleum industry in 1926. RICHARD KISSLING. *Fortschrittsber. Chem. Ztg.* 1927, 78–84.

Analysis of ashes from Baku crude oil. V. A. SILBERMINZ. *Neftyanoe Khozyaistvo* 12, 843–4(1927).—The following elements were found: Fe, Ca, Mg, sometimes S, P, As, Si, Al, traces of Ag, Au, Mn, Pb.

Comparison between American and Russian gasolines. S. NAMEKIN. *Neftyanoe Khozyaistvo* 12, 52–6(1927).—Tables are given of tests for 9 brands of American and 2 of Russian gasolines. The American gasolines contain 8–9 and up to 20% of unsatd. hydrocarbons, the Russian below 1%. American gasolines are blended with cracked gasoline which gives a better quality fuel with regard to knocking than the Russian, the latter being a straight-run product.

The origin and constitution of naphthenic acids. B. TIUTIUNNIKOV. *Neftyanoe Khozyaistvo* 10, 797–806; *Chem. Zentr.* 1926, II, 2519–20; cf. C. A. 18, 2423.—A no. of hypotheses assume that the naphthenic acids are formed at the same time as the hydrocarbons of petroleum and from the same parent substances. According to the theory of org. origin, unsatd. acids from fats would then be the parent substances of naphthenic acids, and the satd. acids of the fats would accompany the naphthenic acids in petroleum. To explain the absence of these satd. acids, aluric acid, stearic acid and 3 naphthenic acids were boiled for 21–24 hrs. with 20% of diatomaceous earth.

Two of the last acids lost less CO_2 than the lauric acid and stearic acid. To prove the formation of naphthenic acids from acids of the oleic acid series, com. cod-liver oil and olive oil were distd. with 20% of the decolorizing powder "Silicia." The only product was a neutral oil consisting chiefly of (1) unsatd. hydrocarbons and of compds. which are apparently ketones and (2) unsatd. aliphatic acids, oxidation of which by KMnO_4 yielded hydroxy acids which m. approx. 36° and give Cu salts sol. in benzene. From cod-liver oil were obtained di-acids but no naphthenic acids. Another group of hypotheses considers the naphthenic acids as secondary transformation products of hydrocarbons. By atm. oxidation of petroleum, however, few or no naphthenic acids are formed. It is thought by T. that this is because of too energetic oxidation, in fact atm. oxidation of Mn naphthenate at $110\text{--}120^\circ$ for 20 days yields sp. heavy acids of peculiar odor which give no Et esters with fruit odor and no Cu salts sol. in benzene and which closely resemble the acids obtained by energetic oxidation of vaseline oil. When oxidized with KMnO_4 , these acids form di-acids with acid no. 243, sapon. no. 296 and cryoscopic mol. wt. 348. Similar di-acids, which are obviously formed by oxidation-condensation of naphthenic acids, thus: $-\text{Me} + \text{Me}- + \text{O} \longrightarrow -\text{CH}_2\text{CH}_2- + \text{H}_2\text{O}$, were also obtained, together with AcOH and butyric acid, from naphthenic acids by oxidation with KMnO_4 . Further oxidation by CrO_2Cl_2 was attempted by adding dropwise CrO_2Cl_2 in CS_2 to the acids in CS_2 . With solns. over 5% concn., the reaction mixt. turned to a gel which, besides a product of CS_2 and CrO_2Cl_2 , consisted of Cr derivs. of the acids which were probably keto acids, since on oxidation they yielded naphthenic acids of low mol. wt. The acid no. of the keto acids was only slightly lower than that of the original naphthenic acids. They had a higher d. than water, were sol. in EtOH, Et₂O and C_6H_6 and insol. in petr.-ether. The Et esters did not have a fruit odor and the Cu salts were not sol. in benzene.

C. C. DAVIS

The near future of naphthene petroleums. K. KOSTRINE. *Neftyanoe Khozyaistvo* 9, 754-6(1925); *Chem. Zentr.* 1926, I, 2990.—Because of the poisonous properties of PhEt_4 , attention is being given to the utilization of naphthenes or C_{10}H_8 (though the combustion of C_{10}H_8 involves the formation of C) as anti-detonators. Since the anti-detonator effect usually increases with the proportion of C in the mol., and since hydrocarbons poor in H have higher ds. than hydrocarbons rich in H, of the same b. ps., the fuel with the higher d. for a given b. p. shows the highest temp. of explosion. In this respect Baku benzine is superior to all American products.

C. C. DAVIS

The behavior of oils with reference to freezing and melting. H. VOGEL. *Erdol u. Teer* 3, 534-9(1927).—In a mixt. of liquids which form both amorphous and crystalline solids such as the mineral oils, the cold point or pour point fails as a characteristic const., because of great variation, due to supercooling, etc., in the hands of different operators. Much more exact (within 1°) is the point of initial flow proposed by V. The app. for detg. this is a modification of the Vogel-Ossag viscometer, a U tube with a narrow and a wide arm, supported by side tubes, in an unsilvered Dewar vessel, about 4 cm. wide and 18 cm. deep. The sample in the U tube is cooled by solid CO_2 and alcohol, until completely solid. A pressure of 60 cm. water column is then applied through the side tube, to the wide arm closed by a rubber stopper and thermometer dipping into the sample, which is allowed to warm up slowly. The alc. is agitated with a stream of air, and the temps. of both oil and alc. are noted at which the level of the oil, in the narrow arm, originally at mark (1), passes mark (2) slightly above it. This is the point of initial flow. If the above app. is not available, a simpler one, described in Holde, 6th ed., page 11, may be substituted. For further information, the viscosity curves, with ascending and descending temps., are detd. in the same app. by measuring the time required for the oil level to rise from mark (3) to mark (4) in the narrow arm, under 60 cm. water pressure on the wide side, at various temps. The viscosity is calcd. by multiplying by a factor, obtained by standardization with an oil of known viscosity. The mean of the temps. inside and outside of the U tube, which should not differ by more than 3° , is the one taken. By trial with a number of different types of oils, some giving a good deal of paraffin and some not, it was found that the rising-temp. curve lies above the falling-temp. curve in the range where paraffin crystals are present. The difference is a measure of the paraffin content. The point beyond which the two curves coincide shows the m. p. or disappearance of the A. S. T. M. cold point. But with the others, the former varied from 19° below to 13° above the latter and extensive super-cooling capacities are shown.

F. S. GRANGER

The thermodynamics of oil refining as bearing on the design of plant. W. C. MITCHELL. *J. Inst. Petroleum Tech.* 13, 481-6(1927).—An address. Fuel economy and fractional distn. are especially discussed.

GEORGE CALINGAERT

Method of determination of paraffin in petroleum products. N. CHERNOSHUKOV. *Neftyanoe Khozyaistvo* 9, 77-80(1925); *Chem. Zentr.* 1926, II, 2521.—Pour into a graduated cylinder 10 g. of sample, shake until dissolved with 10-15 parts of petr.-ether (with fractions below 80° removed). add 15-20 cc. of H_2SO_4 (d. 1.84), shake 5 min. and let settle 1 hr. If the benzene layer is colorless, even though turbid, read its vol. Evap. 50 or 100 cc. to 10-15 cc., add immediately 30-40 cc. of Et_2O and then 30-40 cc. of $EtOH$, maintaining the temp. at -20° . The ppt. of paraffin must be rapidly filtered under suction. If the benzene is turbid it can either be neutralized with 2.5% $NaOH$ or mixed with fuller's earth and exdtd. with petr.-ether. A correction for the soly. of paraffin in $EtOH-Et_2O$ is unnecessary, contrary to Holde. The $EtOH-Et_2O$ mixt. can, if desired, be replaced by butanone. The paraffin content obtained by this method varies about 10% according to whether the sample is first distd. or not. In general the results are somewhat higher than those obtained by the method of Holde. If the paraffin soln. is first pptd. at 0° and then the filtrate at -21° , the paraffin is sepd. into hard and soft fractions, the relative quantities of which can thus be detd. C. C. D.

Determination of tarry substances in oil products. N. CHERNOZHUKOV. *Neftyanoe Khozyaistvo* 12, 697-8(1927).—Five cc. H_2SO_4 (d. 1.84) and 5 cc. of oil product to be tested are poured carefully into a graduated 15-cc. container, and shaken vigorously for 5 min. If a clear soln. is not obtained add 1-2 drops of naphthenic acid, shake and centrifuge for 5 min.; a clear sepn. is then obtained. A. A. BOEHTLINGK

Standard types of the American cracking industry. SEDLACZEK. *Teer* 25, 245-8, 332-5, 418-20(1927); cf. *C. A.* 20, 3559.—A description of standard app. used in the Burton, Burton-Clark, Dubbs, Greenstreet, Hall, McAfee, Rittmann, Cross, Fleming, Jenkins, Coast-Costen and Isom processes. F. S. GRANGER

Ozocerite. K. MARKOV. *Neftyanoe Khozyaistvo* 9, 767-88; *Chem. Zentr.* 1926, I, 2990.—Survey of the nomenclature, chem. and phys. properties, use, extn. and industrial treatment of ozocerite and of ceresin and its substitutes. A. L. HENNE

Estonian oil shale and its processing. G. BANDTE. *Erdöl u. Teer* 3, 567-8, 583 5(1927).—A general discussion. F. S. GRANGER

New experiences in the field of the utilization of bituminous rock. W. LANDGRAEBER. *Feuerungstech.* 15, 182-3(1927).—A new installation in Stuttgart is briefly described. The distn. residue is burned to provide heat for the distn.; after burning it is used to make *portland cement*. ERNEST W. THIELE

Kerosene and its uses. W. A. WOODROW. *J. Inst. Petroleum Tech.* 13, 398-401 (1927).—A description of the properties of kerosene of various origins and of its uses. GEORGE CALINGAERT

Burning tests of kerosene. W. H. THOMAS. *J. Inst. Petroleum Tech.* 13, 402-9 (1927).—A description of the Saybolt and other methods of testing the burning qualities of kerosene. GEORGE CALINGAERT

The burning of mineral oils in wick-fed lamps. J. KEWLEY and J. S. JACKSON. *J. Inst. Petroleum Tech.* 13, 364-97(1927).—Various grades of kerosene are burnt in wick-fed lamps and the candle-power, brightness and tendency to smoke are studied as a function of boiling range, viscosity, capillarity, S content and chem. compn. High viscosity and high carbon content (aromatics?) cause carbonization of the wick. S causes the white bloom on the chimney. Capillarity detcs. the type of wick to be used. GEORGE CALINGAERT

Detonants and antidetonants. RAFFAEL ARIANO. *Giorn. chim. ind. applicata* 8, 473-6(1926); cf. *C. A.* 21, 2380.—The action of antidetonants accords chiefly with the nuclear theory of Callendar. ROBERT S. POSMONTIER

Spectroscopy of the flame in an explosion motor. A. HENNE and G. L. CLARK. *Compt. rend.* 184, 26-8(1927).—The relationship between detonation and the length of the spectrum was investigated. Three spectrum series were photographed with a motor running normally, then with heavy detonations and finally with a fuel to which anti-detonant compds. were added. The detonation is a forceful liberation of energy, developed almost entirely in the first quarter of the explosion. Only a very small part of the detonation plays a role in the second half of the explosion. The explosion is regulated by an anti-detonant compd. in such a manner, that the energy liberated by time unit varies little during the combustion, similar to the combustion in a normally running motor. The fact that the lines of Pb appear only in the first quarter of the explosion indicates that the action of the catalyst is only to release the reaction. Many explanations have been offered to elucidate the mechanism of the action of the various anti-detonants. Though correct for certain definite substances, none of them includes all the known anti-detonants, or explains the difference of the influence of compds. of similar constitution. J. A. SZILARD

Production of ashless coke from mineral oil. V. F. GERR AND G. P. UL'YANOV. *Neftyanoe Khozyaistvo* 12, 840-2(1927).—By baking oil-coke or pitch in closed containers at high temp. a product of a very low ash content is obtained. Its applications for electrodes, etc., are discussed and the plant for its manuf. is described.

A. A. BOEHLINGK

The iodine number of transformer oils. V. D. HEYDEN AND K. TYPEK. *Erdöl u. Teer* 3, 471-2(1927).—Efforts are lately being made to classify transformer oils according to their I nos., hitherto little considered in the judging of mineral oils because of lack of relationship to the behavior of the oil in use. To test their value for this purpose the I nos. of several specimens of Russian, German and American transformer oils, in some cases, before and after use, caustic treatment and tar-formation no. oxidation (passing O_2 through the oil for 70 hrs. at 120°) were compared with the % sol. in H_2SO_4 and the tar-formation no., with reference to German and Swiss patent specifications. No correlation was found.

F. S. GRANGER

Evaluation of transformer oils. J. G. FORD. *Ind. Eng. Chem.* 19, 1165-71(1927).—The method used was oxidation in beakers in an air oven at 80° , 100° , 110° or 120° . There is a definite relation between sludge formed and unsatn. Unsaturated compds. are preferentially oxidized. Mixts. of naphthenes of high mol. wt. with paraffin hydrocarbons give an oil with high resistance to oxidation. Temps. other than operating temps. will give false indications as to oxidizability of an oil.

BRIAN MEAD

Deposits in transformer oils. M. STRUNNIKOV. *Neftyanoe Khozyaistvo* 9, 81-3(1925); *Chem. Zentr.* 1926, II, 2521.—Methods of testing transformer oils were investigated. The ppt. obtained by conducting air or O through an oil, the quantity of which is a measure of the unsuitability of the oil, cannot be detd. volumetrically and must be weighed. Air can be used in place of O , though the quantity of ppt. formed in a given time is about 10% less than that formed by O in the same time. Oxidation with Na_2O_2 also gives consistent results. A transformer oil contains at the most 0.007% ash.

C. C. DAVIS

The oxidation of insulating oils. N. BUTKOV. *Erdöl u. Teer* 3, 551(1927).—Several transformer oils of different grades of purity were tested, by the usual methods, and heated in a bomb with O_2 at 14 atm. and 150° for 5 hrs. Less-refined and totally unrefined oils were oxidized very little as compared to oils "over-refined," with fuming H_2SO_4 , or non-sludging oils. This was attributed to catalytic action. Anti-oxidants greatly repress the oxidation, which was measured by O_2 absorbed and $CO_2 + CO$ formed. Sludge formation, in the slightly oxidized oils, corresponded closely to the tar, etc. (by the Na_2O_2 method), in the oil before oxidation, but was much greater in the highly oxidized oils. The resistance of the less-refined oils to oxidation is believed to be due to the presence of anti-oxidants.

F. S. GRANGER

Testing of road oils. W. SCHAFFER. *Z. angew. Chem.* 40, 1034-5(1927).—References and some details are given for conducting the following tests which are proposed for the examn. of road oils: detns. of sp. gr., water or ammonia water, fraction boiling up to 300° , phenols, naphthalene, free hydrocarbons, drop-point, m. p., solidification point, type of pitch, viscosity and ash.

FREDERICK C. HAHN

Lubricating power cylinders of Diesel engines. Report of tests conducted to show ill effects of oxidation. W. O. NORTHCUTT. *Mech. Eng.* 49, 1068-70(1927).—An improved lubricating-oil injection tube, consisting essentially of a ball check valve with a spirally grooved plug at the cylinder end with 2 oil feed lines from the mech. lubricator, is suggested as a means of preventing oxidation of the oil. The valve is set in the cylinder wall at a point between the 2 upper rings when the piston is at the bottom in order that the rings may distribute the oil. The grooves prevent the oil from being whipped out into the cylinder when the rings pass over the valve. Analyses of oils before and after tests are given. N. believes that with proper attention to methods of lubrication the life of the cylinder linings and piston rings will be prolonged regardless of the nature of the crude oil from which lubricating oil was properly refined.

T. E. RONAN

Contribution to the knowledge of "berginization" and a study on the technical chemical investigation of hydrocarbon mixtures. I. H. I. WATERMAN AND J. N. J. PERQUIN. *J. Inst. Petroleum Tech.* 13, 413-23(1927); cf. Waterman and Perquin, *C. A.* 19, 395.—A comparative summary is given of the refractive indices and dispersive power of several samples of hydrocarbons of different groups. It is suggested to test the purity of hydrocarbons by their index of refraction, the bromine value (McIlhiney) and the detn. of mol. wt. (Victor Meyer and Rast methods). This method of investigation was applied to the products obtained by cracking paraffin wax in the vapor phase, in vacuum. Notwithstanding the high temp. used ($450-60^\circ$) for 4 hrs., no cracking occurred, the reason being that the time in the cracking spiral was only 4 sec. In the

cracking of paraffin wax with 10–12% of AlCl_3 at 250–60° for 1 to 4 hrs., there remained a residue (about 56%) in one expt. which proved to be unchanged paraffin wax, while during the cracking 25 to 30% of gasoline had been formed from the part of the paraffin wax which was decompd.

GEORGE CALINGAERT

Asphalt tars. I. Terminology, methods of testing and standards. II. Characterization of the asphalt tars of the U. S. S. R. (Soviet Republic). A. SAKHANOV AND L. SHERDEVA. *Neftyanoe Khozyaistvo* 10, 393–7; *Chem. Zentr.* 1926, II, 304; cf. *C. A.* 19, 3158.—*Asphalt tar* signifies the partly solid or solid residue from the distn. of naphtha tar, a definition which comprises soft asphalt, hard asphalt, glass asphalt, petroleum pitch and residuum asphalt. Blown asphalt obtained by oxidation of naphtha tar by air should be called “oxidized asphalt tar,” and the asphalts obtained by sulfonation of naphtha tar and from the acid residues of the production of asphalt should be called “sulfonated” and “regenerated asphalt tar,” resp. Moreover pitches from petroleum tar and from coal tar should be called asphalt tar. Finally fossil tars should be called “natural asphalt tars,” while “asphalt” should include natural mixts. of limestone with asphalt tar and artificial mixts. used in building. The testing comprised detns. of the ash, insol. C, softening temp., permeability, flash point, extensibility and d. In part II the results of tests of 17 Russian asphalt tars are compiled.

C. C. DAVIS

Asphalt and tar. P. SCHLÄPFER. *Monats.-Bull. Schweiz Ver. Gas Wasserfuchm.* 5, 85 8, 124–30, 173–5, 364–74; *Chem. Zentr.* 1926, II, 143.—Bituminous materials for street construction are classified in 3 chief groups: (1) petroleum asphalts, (2) coal tar products, and (3) special products (emulsions, mixts., etc.). The 1st group is in turn divided into (1) natural asphalts, including true asphalts or mineral pitches, asphaltites or glance pitches and asphalt rocks (asphaltic lime and asphaltic sands), and (2) artificial asphalts, which include on the 1 hand thick liquid to soft solid and on the other hand hard pitch-like distn. residues, both of which are predominantly petroleum products with an asphalt base. The formation of asphalts in nature from petroleum with an asphalt base depends upon the action of O and of S and upon polymerization. The naphthenes, olefins, terpenes, aromatic hydrocarbons and petroleum resins are by far most subject to these influences. Asphaltenes are formed after the formation of asphaltogenic acids as intermediate products. The asphaltenes are sol. in C_6H_6 and in CHCl_3 , and are transformed in turn to asphaltites and carbenes, which are almost insol. in these solvents. In regard to their sepn., classification and nomenclature there is still no agreement among individual investigators. For the valuation of asphalt for street building materials, the phys. properties are of special importance, and they are independent of the chem. character of the materials.

C. C. DAVIS

Decomposition of wood on heating under pressure in alkaline solutions. ERIC HAGGLUND. *Svensk Kem. Tids.* 39, 90–6(1927).—Wood shavings were treated with H_2O and varying quantities of NaOH (0–30 g. per 100 g.) in an autoclave at 350° (200 mm.). The results are presented in extensive tables. The gas evolved consisted mainly of H_2 and CH_4 .

A. R. ROSE

Phenols from coniferous wood tar. PETER KLASON AND HJ. MELLQUIST. *Svensk Kem. Tids.* 39, 75 80(1927).—Distil. fractions of wood tar (7 fractions between 179° and 260°) gave, *p*- and *m*- but no *o*-cresol, guaiacol, creosol, ethylcreosol and a creosol with Pr, not eugenol (Pictet and Gaulis, *C. A.* 17, 3019), possibly isoeugenol. The largest fraction consisted of creosol.

A. R. ROSE

Sesquiterpenes in birch tar oil. K. A. VESTERBERG AND J. NYDAHL. *Svensk Kem. Tids.* 39, 117–21(1927).—Birch tar oil was scrubbed, dried and fractionated into 5 parts: 110–15°, 115–20°, 120–25°, 125–30° and 130–35°. The physical constns. of these are, resp.: n_D^{20} 0.882, 0.890, 0.898, 0.893, 0.987; $[\alpha]_D$ 5.6, 13.2, 21.98, 16.32, 8.4; n_D^{19} 1.493, 1.500, 1.504, 1.501, 1.502. These fractions are very likely made up of sesquiterpenes with some acids. The first one is in agreement with constns. for betulol (Semmler, *Ber.* 18, 1417). All fractions on dehydration gave a picrate, m. 127°, which is not identical with that reported by Ruzicka (*C. A.* 5, 345, 927). A naphthalene-like compd., $\text{C}_{13}\text{H}_{14}$, was recovered from the picrate with n_D^{22} 1.5872, b. 252°, indicating that part of the sesquiterpenes are bicyclic.

A. R. ROSE

Possible use of shale oil as a wood preservative (SOWDER) 20. The age of the H_2S contamination of the sea basin in the Crimea-Caucasus region and the processes of formation of petroleum (ARCHANGELSKII) 8. The determination of water in oils (PFLUG) 27. Jet and jetonized material (CRAIG) 8. Municipal water supply in the oil fields (VEATCH) 14. Bituminous composition containing rubber (Brit. pat. 263,028) 30. Filter for gasoline (Brit. pat. 263,017) 1. Tetra-alkyl Pb compounds (U. S. pat. 1,645,389) 10. PbEt_4 (U. S. pat. 1,645,375) 10.

Cracking and converting petroleum oils. W. M. CROSS. U. S. 1,643,446, Sept. 27. Oil is heated to a cracking temp. and all the oil to be treated is collected in a reaction zone while maintaining temp. and pressure conditions which will effect conversion of the oil in the liquid phase; all conversion products are withdrawn from the reaction zone in a small stream, pressure is released on the stream and steam is injected into it; the mixt. of oil and steam is then admitted to an enlarged zone maintained under reduced pressure to effect distn. of lighter fractions of the conversion products. An app. is described. Cf. C. A. 21, 1883.

Separating constituents of petroleum emulsions. G. W. COGGESHALL and A. REILLY. U. S. 1,643,698, Sept. 27. Gravity sepn. is effected after adding a sulfonated oil material such as sulfo-fatty acids of the Twitchell process and a salt soln. U. S. 1,643,699 specifies use of a soap soln. and a salt such as NaCl.

Cracking heavy hydrocarbon oils. W. S. YARD and E. N. PERCY. U. S. 1,643,401, Sept. 27. Heavy hydrocarbon liquid is sprayed upon a deep bed of solid fuel maintained incandescent in a closed chamber, the vapors formed are passed into a second chamber over a mass of finely divided carbonaceous material, elec. heated to incandescence and the vapors and carbonaceous material are subjected to the action of steam to prevent clogging of the carbonaceous material with products of the cracking and the vapors are then further passed through the carbonaceous material to effect their cracking.

Converting hydrocarbons into others of lower boiling point. E. H. LESLIE and B. R. TUNISON. U. S. 1,644,736, Oct. 11. The surfaces of bodies of liquid hydrocarbons such as a residuum oil of 14-6° Bé. and a lighter distillate are brought together, e. g., by superposing the lighter distillate on a body of the heavier oil by intermittent addition, and a temp. is maintained which will effect conversion. An app. is described.

Converting oils. W. M. CROSS. U. S. 1,644,991, Oct. 11. Oil is raised to a cracking temp. in a "heating stage," passed to a "conversion stage" and maintained under sufficient pressure from the vapor generated to maintain most of the oil in liquid phase, the pressure is then relieved and the oil is passed through a vaporizing stage and vapors evolved are subjected to fractional condensation and a portion of the condensate is returned to the heating stage and to the fractional condensation stage with the charging stock. A regulated liquid level is maintained in the vaporizing and fractional condensing stages. An app. is described.

Purification of hydrocarbons. C. WEGNER. Can. 273,682, Sept. 6, 1927. Light hydrocarbons are purified by heating with $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$ and then distg.

Apparatus for fractionating petroleum oils. F. A. MILLIFF and J. A. MILLIFF. U. S. 1,644,937, Oct. 11.

Battery of continuous stills for distilling hydrocarbon oils. J. R. CARRINGER. U. S. 1,644,324, Oct. 4.

Oil gas. R. D. PIKE. U. S. 1,644,146, Oct. 4. A supply of oil is treated with steam and passed over heated surfaces in a closed chamber to convert the oil and steam into lean gas carrying suspended C particles; the lean gas and suspended C are then further heated and treated with steam in another closed chamber to convert the C into gas, and the lean gas mixt. is enriched. An app. is described.

Illuminating oil. F. W. HALL. Can. 274,478, Oct. 4, 1927. An illuminating oil is manufd. by treating a viscous hydrocarbon oil with H_2SO_4 , then subjecting the treated oil to upward filtration through fuller's earth and finally mixing the oil with a kerosene fraction of petroleum.

Manufacture of lubricating oils with low melting point from paraffin-containing distillates. AKTIEBOLAGET SEPARATOR-NOBEL. Swed. 62,844, April 27, 1927. The larger paraffin crystals formed by cooling are filtered off and the remaining paraffin is removed by centrifugalizing after addn. of a diluent lowering the sp. gr. of the liquid component. Cf. C. A. 20, 2246.

Bituminous composition. R. ILLEMANN. Brit. 262,961, Dec. 31, 1925. An elastic waterproof compn. is made by adding a liquid bituminous substance or a "mineral wax" to a heated creamy suspension of stone flour in H_2O , and boiling and stirring to obtain a stiff pasty material.

Bituminous composition for paving, roofing or other purposes. C. S. REEVE. U. S. 1,643,520, Sept. 27. A mixt. of coal-tar pitch and an oil shale is heated at about 340-50° for 5-10 hrs. U. S. 1,643,521 specifies heating oil shale and coal-tar oil together at 310-20° for 10-15 hrs.

Bituminous emulsion for use in briquets or on roads or for other purposes. J. A. MONTGOMERIE. U. S. 1,643,675, Sept. 27. Mexican asphalt which is solid at ordinary temp. is melted and poured into a dil. caustic alkali soln. at a temp. of about 102°

and the mixt. is stirred to effect reaction between the alkali and a portion of the ingredients of the asphalt.

Distilling bituminous materials. C. N. FORREST and H. P. HAYDEN. Brit. 262,959, Dec. 28, 1925. Materials such as heavy asphaltic residues or gilsonite or grahamite are distd. in the presence of a carrier consisting of pieces of inert refractory material and by the heat generated by the combustion of the coke which remains on the carrier after the distn. An app. is described.

Furnace and process for carburizing saw-mill waste. P. JOHNSON. Swed. 63,511, Aug. 16, 1927. The material is packed in crates which are hung up in retorts heated from a common fireplace. The plant works continuously.

Recovery of acetic acid. H. SUDA. Can. 274,719, Oct. 18, 1927. The mixt. of wood gases, pyroigneous acid vapors and wood spirit vapors leaving a wood carbonization app. is completely detarred and subjected in gaseous condition directly to extn. with an extn. agent difficultly sol. in H_2O and having a b. p. higher than that of $AcOH$, the $AcOH$ being completely removed from the mixt. in this manner and withdrawn in a coned. state as a liquid with the extn. agent.

23—CELLULOSE AND PAPER

CARLETON F. CURRAN

Cellulose. XXVIII. Acetolysis of cellulose. III. Formation of cellobiose. HERMANN PRIESE and KURT HESS. *Ann.* 456, 38-54 (1927), cf. C. A. 21, 2982.—In the acetolysis of cellulose with $Ac_2O-H_2SO_4$, a 50-51% yield of cellobiose octaacetate is obtained; this is independent of the cellulose material (cotton, linters, ramie, wood cellulose, mercerized cotton or acetylcellulose may be used). Expts. with cellulose triacetate, which in dil. soln. in glacial $AcOH$ has the low mol. wt. of acetylglucosan, show that the formation of cellobiose is also independent of the state of association of the cellulose deriv. The polarimetric changes during acetolysis show a similar parallelism for the different celluloses examd. Exptl. details of the acetolysis are given. **XXIX. Preparative separation of cellulose crystals from bast fibers. (I. From ramie fibers).** K. HESS and GUIDO SCHULTZE. *Ibid* 55-68.—Selected ramie fibers, repeatedly purified with alkali, Cl_2O and Na_2SO_3 until ash free ($[\alpha]_{435}^{18}$ 3.41 in cuprammonium hydroxide soln.) is acetylated for 8 hrs. at 70-75° with H_2SO_4 , Ac_2O and C_6H_6 and the triacetate dissolved out in glacial $AcOH$ or $CHCl_3$. The unacetylated cellulose appears in the form of spindle-shaped crystals, 0.05-0.1 mm. long, suspended in the soln. and may be sepd. by sedimentation from the detritus with which it is mixed. The crystals are identical chemically with pure cellulose prepd. from crystd. diacetate. The "inter-crystal substance" which is removed as triacetate, when regenerated from the latter by hydrolysis with 2 N $MeOH-NaOH$, shows in cuprammonium soln. a slightly smaller optical rotation than the crystals. **XXX. Acetolysis of cellulose with hydrobromic acid and acetyl bromide.** FRITZ MICHEEL. *Ibid* 69-86.—Cellulose acetate in 10 parts $AcBr$ contg. 5-10% HBr at 0° changes in rotation from -0.1° to 170° in 14 days; after 4.5 days the rotation is const. at about 135° for 24 hrs. The final mol. wt. (dtd. from the Br reactive with $AgOAc$ or Ag_2CO_3 in $MeOH$) indicates the complete decompn. of the cellulose. After the reaction of 5% HBr in $AcBr$ upon acetobromocellobiose at 0° for 11 days, 71% of the cellobiose was recovered; with 7.5% HBr in $AcBr$ at room temp., complete degradation took place. After reaction with $AgOAc$ in $AcOH$, equal amts. of glucose pentaacetate and a glucose acetate contg. 10% Br were obtained. Acetobromoglucose is nearly quant. recovered after the action of 7.5% HBr in $AcBr$ for 13 days. Cellulose acetate (30 g.), treated with 300 g. $AcBr$ and 18 g. HBr for 23 days at 5°, gives 9.5 g. of an amorphous *trihexosan nonaacetate*, $C_{36}H_{48}O_{24}$, m. 123-6°, $[\alpha]_D^{20}$ 86.6° ($CHCl_3$), mol. wt. in C_6H_6 , 827; in $CHBr_3$, 851; in $AcOH$, 834. It forms addn. compds. with $PhMe$, $C_6H_5Me_2$ and $CHBr_3$. Sapon. with $MeOH-NH_3$ at 0° gives *trihexosan*, m. 184-9°, $[\alpha]_D^{17}$ 90.5° (H_2O), $[\alpha]_D^{19}$ 96.8° ($MeOH$), mol. wt., H_2O 445. Methylation gives a *nonamethyltrihexosan*, amorphous, m. 84-91°, $[\alpha]_D^{19}$ 94.8° ($CHCl_3$), mol. wt., H_2O , 600. Degradation with 35% $MeOH-HCl$ at 0° for 3 days gives 2,3,6-trimethylglucoside, m. 108-10°, hydrolyzed with 5% aq. HCl to 2,3,6-trimethylglucose, m. 103-7°, $[\alpha]_D^{17}$ 70.2°.

C. J. WEST

Hemicelluloses. ROBERT HAZARD. *Russa* 2, 581, 583; *Rev. gén. mat. plastiques* 3, 505-6 (1927).—A brief discussion of the significance attached to the term "hemicellulose" by various authors.

A. PAPINEAU-COUTURE

Standard celluloses. C. G. SCHWALBE. *Paper Trade J.* 85, No. 12, 53-6(1927).—See C. A. 21, 1705. A. PAPINEAU-COUTURE

General study of the chemistry of cellulose and its principal derivatives. II. Experimental part. H. GAULT AND P. EHLMANN. *Caoutchouc & gutta-percha* 24, 13706-7(1927); cf. C. A. 21, 2794.—The caproates were prepd. by the same general methods as before. *Cellulose monocaproate* formed a tough, fibrous mass, insol. in all solvents tried, and softened around 250°. *Cellulose dicaproate* is pptd. from C_6H_6 as very fine fibers, is sol. in all the solvents of cellulose laurates, particularly in aromatic hydrocarbons, softens at 140° and m. 180°. *Cellulose tricaproate* forms a very hard granular mass and cannot be pptd. in fibrous form. It softens at 100° and m. 230°.

C. C. DAVIS

Cellulose and cornstalks. J. F. JACKSON. *Paper Mill* 50, No. 36, 2, 20(1927).—The *Dorner process* consists essentially in cooking corn-stalks (including nodes, leaves and pith) with a weak NaOH liquor for 1 hr. at low pressure, draining off the liquor, and then cooking for 5 hrs. at a slightly higher pressure with a stronger NaOH liquor. Yields of 33-35% of pulp contg. 95% α -cellulose are claimed; while if a lower α -cellulose content in the pulp is satisfactory higher yields can be obtained. A. P.-C.

Researches on benzoyl cellulose. I. KATSUMOTO ATSUKI AND KICHIRO SHIMOMYAMA. *Cellulose Ind. Tokyo* 2, 336-40(1926).—Dibenzoate of cellulose is prepd. by warming regenerated or normal cellulose (1 part), mercerized with 35% NaOH soln. and aged for 24 hrs. at ordinary temp., with NaOH (4 parts) and 20% C_6H_6 soln. of $Ph.COCl$ (10 parts) at 50-60° for 1-2 hrs. The product is poured into H_2O and washed several times with hot H_2O . The product from regenerated cellulose gives a clear soln. in $CHCl_3$ and Me_2CO and is apparently degraded to a marked extent as indicated by its low viscosity and the large Cu no. which is the main cause of the brittleness of the film. The benzoate from normal cellulose is not clearly sol. in $CHCl_3$, giving a turbid soln. The dispersion is not complete after several days and the filtration is very difficult. The viscosity of the soln. is very high perhaps because of the presence of swollen fragments of the benzoate. The film obtained has the tensile strength 5 kg. per sq. mm. and elongation 5%, but it is very brittle. The cellulose of the benzoate from normal cellulose is not so much degraded and the brittleness of the film is not attributed solely to the degradation of the cellulose. The imperfection of the dispersion seems to play also an important role in the brittleness of the film. K. K.

Decomposition of cellulose by heating under high pressure in presence or absence of hydrogen, with or without a liquid dispersing medium. H. I. WATERMAN AND J. N. J. PERQUIN. *Chimie et industrie Special No.*, 277-89(May, 1927).—See C. A. 21, 1705. A. PAPINEAU-COUTURE

Biochemical decomposition of cellulosic materials, with special reference to the action of fungi. R. D. REGE. *Ann. Appl. Biol.* 14, 1-44(1927).—In mature plant materials, pentosans form the most important food of microorganisms. These compds. are easily attacked whereas the other furfural-yielding compds. are resistant. The Klobber and Tollens method for the detn. of pentosans is not specific for these compds. R. suggests a method which requires the detn. of the furfuroids in the cellulose obtained by the chlorination method and the deduction of this value from the total furfuroids. The decompn. of ripe cellulosic materials in the presence of assimilable N is apparently controlled by 2 factors: (1) the energy factor (pentosans); (2) the inhibiting factor (lignin). If the ratio, energy factor: inhibiting factor is > 1 , the material is easily decompd.; if < 0.5 , the material is very resistant to the attack of microorganisms. By this means susceptibility to decompn. can be predicted. This ratio could not be increased by the addn. of carbohydrate to the resistant materials. Mannose and galactose are apparently not suitable food for the organisms concerned in this process. The pentosan part of hemicelluloses is most important as microbial food. Fungi are more important than bacteria in the early stages of the decompn. of cellulosic materials. The N of fungal bodies is not readily available. In the later stages of decompn. fungi are decompd. by other organisms. Certain fungi isolated from decomp. heaps of cellulosic material can grow at high temps. and on purified C constituents of plants. The presence of almost all the enzymes necessary to hydrolyze the complex C compds. was ascertained. These activities of the fungi confirm their importance in the decompn. of cellulosic materials. C. H. RICHARDSON

Correction to article by K. Hess and G. Schultze, "Cryoscopic behavior of cellulose acetates." K. HESS. *Ann.* 457, 307-8(1927); cf. C. A. 21, 2982.—Correction of certain optical activity values are given. C. J. WEST

Pulp supplies of the future. New and simple process of manufacturing bamboo cakes (semi-pulp or quarter-stuff) suitable for cheap transport. A. H. LYNN. *Paper*

Maker and Brit. Paper Trade J. 74, 65-7(1927).—A process recently developed in Germany consists essentially in removing the leaves of the bamboo, cutting the stems into suitable lengths, and thoroughly disintegrating them in a specially designed machine (not described); the disintegrated bamboo is cooked with $\text{Ca}(\text{OH})_2$ for about 10 hrs., washed, and pressed into cakes under just enough pressure to cause proper cohesion of the cakes on subsequent drying, which is carried out in the air or in a drying tunnel. The dried cakes contain from 30 to 40% more fiber than wood per unit vol., and from 5 to 15% more per unit wt. The material can be converted into soda pulp by treatment with a relatively small quantity of NaOH at low pressure. The economic possibilities of the process are briefly discussed.

A. PAPINEAU-COUTURE

The bamboo hope. W. RAITT. *Paper Maker and Brit. Paper Trade J. 74, 15-26; World's Paper Trade Rev. 88, 4-16, 84-8; Paper Makers' Monthly J. 65, 266-71; Paper Mill 50, No. 31, 16, 36-40(1927).*—An address discussing the possibilities of bamboo as a substitute for wood in the manuf. of paper, based on R.'s lab. and com.-scale expts. during the last 25 yrs. Thanks to the fractional digestion process (C. A. 8, 247; 11, 1546; 16, 1012; 19, 3590), the position arrived at now, contrasted with that of 25 yrs. ago, is as follows: knots or nodes usable, unusable; NaOH used on bamboo 16, 24%; bleach used (on unbleached pulp) 8, 22%; steaming time 5, 10 hrs.; steaming pressure 24, 80 lbs.; yield of unbleached pulp 45, 37%; yield of bleached pulp 42, 32%, resp. R. estimates that unbleached bamboo pulp can be delivered c. i. f. British ports at a lower cost than the present price of unbleached soda wood pulp. The quantities available, forest population and lime supply are discussed.

A. PAPINEAU-COUTURE

Production of pulp with high α -cellulose. G. A. RICHTER AND M. O. SCHUR. *Paper Trade J. 85, No. 8, 48-9(1927).*—See U. S. pat. 1,599,489, C. A. 20, 3566; U. S. pat. 1,602,553, C. A. 20, 3814.

A. PAPINEAU-COUTURE

Value of p_H determinations for controlling sulfite pulp manufacture. RENÉ ESCOURROU AND PAUL CARPENTIER. *Chimie et industrie 18, 13-23(1927); Papeterie 49, 690-7, 737-41, 782-6(1927).*—Contrary to Taylor (C. A. 20, 1519), E. and C. find that the acid concns. used in the sulfite pulp manuf. are not so high as to preclude the use of p_H detns. for controlling the acid making and cooking operations. The color of the liquors is such that colorimetric detns. may be used. Raw acid from the limestone towers has a p_H of about 2.0, which is reduced by about 0.4 by strengthening with relief gas and liquor in the recovery tank or tower. Improvement in results by cooking with liquor contg. neutral salts (e. g., NaCl), which is generally attributed to better penetration of the liquor into the wood, is really due to a modification of the p_H of the liquor, which is brought into the optimum zone. Addn. of chlorides lowers the p_H and addn. of sulfates raises it, presumably because of combination of a no. of H_2O mols. with each chloride mol., while the action of sulfates is due to the probable formation of addn. compds. complicated by hydration. For each species of wood there is an optimum p_H value for the cooking liquor, which is about 2.0 for resinous woods, but which also varies with the moisture content of the chips and the surface tension of the liquor. Systematic study of the variation in p_H of the liquor during 3 industrial cooks for different grades of pulp showed that it first rises (period of impregnation), then falls (disincrusting period) and finally rises again (second impregnation period). In cooking for easy-bleaching pulp, the second impregnation period is omitted and the period of disincrusting is conducted slowly and in such a manner as to obtain as low a p_H value as possible at the end of the cook, short of the point at which the liquor "turns." Important savings can be effected by re-using the water repeatedly in dilg., rifting, screening and thickening the stock, provided it is renewed whenever it becomes too heavily loaded with sol. impurities, which is readily controlled by means of p_H detns.

A. PAPINEAU-COUTURE

Some recent progress in the cellulose industries. M. BROU. *Papier 30, 841-7(1927).*—An address briefly reviewing both established and new processes, including special phases such as pulp for rayon and wood substitutes.

A. PAPINEAU-COUTURE

Strength testing of wood pulp. The proposed standard test conditions for determining the initial strength of pulp. G. P. GUNBERG. *Paper Trade J. 85, No. 11, 51-8(1927); cf. C. A. 21, 1350; Cameron, et al., C. A. 21, 1350.*—A reply to criticisms of the method as published, with a further discussion of the various conditions of the method.

A. PAPINEAU-COUTURE

Recovery of expressed soda in the alkali cellulose process. UGO ORLANDI. *Giorn. chim. ind. applicata 8, 35-7(1926).*—A process depending upon electrolysis of the expressed soda with Hg electrode.

ROBERT S. POSMONTIER

Sulfur recovery from relief gases and liquor. G. A. RICHTER. *Paper Trade J.*

85, No. 8, 45-8(1927).—See U. S. pat. 1,599,488, C. A. 20, 3570; U. S. pat. 1,616,703, C. A. 21, 1011.

Modified sulfite pulping process. G. A. RICHTER. *Paper Trade J.* **85**, No. 8, 56(1927).—Description of U. S. pat. (C. A. 21, 496). In pulping wood by the sulfite process using a Na instead of Ca base, a portion of the base can be supplied in the form of niter cake (NaHSO_4), and can give a high-grade pulp essentially equiv. to those produced by the usual Na base sulfite liquors. The amt. of H_2SO_4 present in the liquor is not sufficient to injure the fiber, and it promotes liberation of the fibers at a lower temp. and in a shorter time.

The chemistry of sulfite cooking. W. H. BIRCHARD. *Paper Trade J.* **85**, No. 12, 50-61(1927).—An account is given of observations made in the course of exptl. sulfite cooks in a glass digester of 540 cc capacity. Convection currents were set up that kept up a considerable circulation, and when gas was relieved from the top of the digester ebullition of the gas caused violent circulation; at no time was there appreciable difference in color of the liquor at the top and bottom of the digester. The progress of penetration of the chips by the acid was about 9 times faster from the ends than from the sides, and as the rate of penetration is the same for all chips, irrespective of size, uniform penetration requires uniform chip size. No evidence was found that lignosulfonic acid polymerizes under the conditions existing in the sulfite process; but if the temp. is raised too rapidly, before the chips have been properly penetrated and both aldehyde groups have been sulfonated, there is danger of the partially sulfonated lignin polymerizing to form insol. resins; or if the lignosulfonic acid is not neutralized by the base as rapidly as formed, it may act on the cellulose in a manner similar to H_2SO_4 . It is unadvisable to exceed 145° in cooking, as cellulose begins to decompose at about 150° . On heating sulfite liquor (5.15 total, 3.84 free, 1.31% combined SO_2) a crusty ppt. began to form at 128° and between 70 and 75 lbs. pressure. If the contents of the digester were allowed to cool, analysis of the ppt. showed it consisted practically entirely of CaSO_3 ; but if the liquor was withdrawn at max. pressure the ppt. consisted of a mixt. of $\text{Ca}(\text{OH})_2$ and CaSO_3 . This is attributed to the reaction $\text{Ca}(\text{HSO}_3)_2 + 2\text{H}_2\text{O} \rightleftharpoons \text{Ca}(\text{OH})_2 + \text{H}_2\text{SO}_3$, which proceeds to the left at low and to the right at high temps.; but as H_2SO_3 cannot exist above 120° (unpublished work by W. B. Campbell), the reaction goes to completion above this temp. Conclusion: Above 120° sulfonation of the lignin is accompanied by an alk. hydrolysis of the β -cellulose and other carbohydrates by the $\text{Ca}(\text{OH})_2$, which is the probable explanation of the production of easy-bleaching pulp cellulose with sulfite liquors high in base. This is confirmed by the fact that with such a liquor an easy-bleaching pulp was obtained which, after beating for 30 min., gave a parchment-like sheet which could not be tested with an Ashcroft tester, the stock showing unmistakable signs of hydrolysis and hydration.

The determination of the copper number. D. CLIBBENS and A. GRAKE. *Paper Trade J.* **85**, No. 12, 62(1927).—Because of C. G. Schwalbe's work on the Cu no. detn., it is suggested that all methods for this detn. be prefixed with his name, e. g., Schwalbe-Hägglund, Schwalbe-Braidy, etc. The latter has been found greatly superior to the former in testing materials with low Cu no., such as are used in the textile industry, but it may require modification for use with materials having a high Cu no., e. g., wood pulps. No evidence has been found that the swelling of cotton cellulose exercises any influence on the quant. absorption of methylene blue, such differences as have been noted being traceable to purely chem. differences rather than to differences in the degree of swelling.

New developments in artificial silk. A. J. HALL. *Dyer, Calico Printer* **58**, 50-1(1927).—The fine filaments and hollow fibers of the older rayons, and acetate silk are discussed.

Faults of artificial silk. INVESTIGATOR. *Silk J.* **4**, No. 38, 53-4(1927).—The effects of variations in denier, twist, tension, color, warping, sizes, sizing, etc., are discussed. Cf. C. A. 21, 1015.

Purification of caustic soda from viscose refuse. LEONARDO CERINI. *Giorn. chim. ind. applicata* **8**, 227-35(1926).—Description of a patented process which makes use of cotton cloths as dialyzing membranes for osmotic pressure.

Recovering alcohol and ether in rayon making. G. WEISSENBERGER. *Rayon J.* **2**, No. 4, 27-30(1927).—Modern processes and app. for washing the vapors from the manuf. of nitro silk are described and discussed.

Austrian black pine (*Pinus Austriaca*) as a paper-making material. L. VIDAL and M. ARIBERT. *Papier* **30**, 731-6; *Papeterie* **49**, 697-702(1927).—Analysis of the air-dried wood gave: H_2O 17, ash 0.5, resins (EtO ext.) 4.3, cellulose 54%. Cooking 12 hrs. at 2.5-3 kg. pressure with 20% NaOH at 5% concn. gave a 65% yield of un-

bleachable pulp, very difficult to defiber in an exptl. beater, but might be easier to treat in a kollergang. If it can be defibered satisfactorily, the pulp would be suitable only for unbleached or colored wrappings. By increasing the proportion of NaOH to 30% (at a concn. of 7.5%) and the time of cooking to 15 hrs., there was obtained 48% of reddish brown pulp, which could not be satisfactorily bleached. It was readily defibered and could withstand drastic beating. By increasing the NaOH to 35% (at a concn. of 8.75%) the yield was reduced to 45%. The latter pulp was somewhat softer, could be defibered easily and bleached to a satisfactory white with 24% of bleaching powder, giving a pulp suitable for the manuf. of fine papers. Boiling the wood 8 hrs. at a pressure of 2.5-3 kg., with 16% NaOH (at a concn. of 4%) and 8% Na₂S (at a concn. of 2%) gave 53% of brown, very strong, homogeneous pulp, which was defibered without undue difficulty. The microscopic characteristics of the pulps obtained, which are very similar to those of pulp from Scotch pine (*Pinus sylvestris*), are described in detail.

A. PAPINEAU-COUTURE

Potato-stem pulp. A micro-consideration. JAMES SCOTT. *Paper Maker and Brit. Paper Trade J.* 74, 262 5(1927).—An illustrated description of the structure of potato and tomato stems, bringing out their possibilities as paper-making materials.

A. PAPINEAU-COUTURE

The disintegration of pine by the sulfite process. C. G. SCHWALBE AND KURT BERNDT. *Cellulosechemie* 8, 66-8(1927).—Exception is taken to Hägglund's work (C. A. 21, 1710) and it is established from his own data that pine heartwood extd. with C₆H₆ or Et₂O cannot be disintegrated by the sulfite process. Hägglund's investigations, made in a bomb tube in which the factors of time, motion, acid concn., max. pressure and chip size differ from com. practice, give no conclusions of value to the technical problem of cooking pine, nor do they indicate the harmful effect from a phys. and chem. standpoint, on the reactivity of comminuted wood subjected to long storage. Cf. C. A. 20, 3810.

I. C. FLECK

Lignin acetals. ERIK HÄGGLUND AND H. URBAN. *Cellulosechemie* 8, 69-71 (1927).—When finely divided wood is treated with AmOH.HCl more than 1/2 the material is dissolved and a light brown semi-acetal, probably C₁₆H₁₀O₆.OMe.OAm, can be isolated from the soln. A lignin acetal with 2 amyloxy groups in the mol. apparently exists in the residue. Wood treated with BuOH HCl yields the corresponding butyloxy semi-acetal, C₁₆H₁₀O₆(OH)₂(OMe).OBu. These expts. indicate a mol. wt. for lignin of about 315, and that it contains one OMe, one C = O and 3 OH groups. I. C. FLECK

Industrial research paper laboratories. C. J. WEST. *Paper Trade J.* 85, No. 6, 49-53(1927).—A list of industrial research labs. working on pulp and paper or related problems, with information regarding their staffs and nature of the work carried out.

A. PAPINEAU-COUTURE

Ailanthus wood as a paper-making material. L. VIDAL AND M. ARIBERT. *Paper Trade J.* 85, No. 7, 49-50(1927).—See C. A. 21, 2062.

A. PAPINEAU-COUTURE

Paper qualities. JESSIE E. MINOR. *Paper Trade J.* 85, No. 13, 41-2(1927); cf. Nourse, C. A. 21, 2983.—A discussion showing that it is not possible to compare the qualities and permanence of 2 papers merely on the α-cellulose content of the raw materials, unless it has been first ascertained that the fibers are of the same kind, that the mech. treatment has been equally drastic, and that the chemicals added during the process of making the paper are identical and have had equal opportunity to attack the fibers.

A. PAPINEAU-COUTURE

Industrial applications of paper products. G. OEHLER. *Z. Ver. deut. Ing.* 71, 545-52(1927); *Paper Industry* 9, 795-9(1927).—Data are given on the mech. properties and machining properties of products such as resin-impregnated paper and boards, pressed boards and pasteboard.

A. PAPINEAU-COUTURE

Paper-fiber disintegration. Some minute problems. JAMES SCOTT. *Paper Maker and Brit. Paper Trade J.* 74, 27-31(1927).—A description of whole, sepd., severed and fibrillated fibers, as seen under the microscope, particularly when examg. torn papers.

A. PAPINEAU-COUTURE

Fixation of basic dyes by vegetable parchment. ABEL CAILLE. *Paper Trade J.* No. 3, 53(1927).—See C. A. 21, 2062.

A. PAPINEAU-COUTURE

Paper-making qualities of the leaves of *Corypha laevis*. F. HEIM DE BALSAC, A. DEFORGE, G. S. DAGAND AND J. MAHEU. *Bull. agence gén. colonies* 20, 51; *Bull. Imp. Inst.* 25, 167(1927).—The leaves of *Corypha laevis* (Lour.), the "Cay La Buong (lata-pier)" of Annam contain on the dry basis (H₂O 8.40%): ash 4.65, fats and waxes 0.60, cellulose 39.10, lignin 55.65%. The ash contained SiO₂ 29.26%, Al₂O₃ 13.15% and aO 49.19%. Cooking the leaves for 6.5 hrs. under a pressure of 3 kg. with a 3.5% aOH liquor gave a brownish yellow pulp which bleached white without much difficulty.

(yield of bleached pulp 32.6% on the dry basis). The pulp consists mainly of long fibers with a wide lumen, varying in length from 0.44 to 1.77 mm. (av. 1.4 mm.), and with an av. diam. of 0.010 mm. The pulp gives a "rattly" paper of little less than av. strength.

A. PAPINEAU-COUTURE

The Emanuelli (paper) porosity tester. L. EMANUELI. *Paper Trade J.* 85, No. 10, 48-50(1927).—The principle of the instrument consists essentially in passing air successively through a definite area of the paper to be tested and through a standard capillary glass tube of known vol. and diameter, and measuring the difference of pressure across the sheet and across the capillary by means of mercury manometers. The theory of the instrument, technic of its use and precautions to be observed are discussed. It has been used satisfactorily in the testing of cable papers over a no. of yrs. The impermeability of paper is defined as the reciprocal to its porosity.

A. P.-C.

Waterproofing and hardening paper by means of aluminum acetate. A. LAM-BRETTE. *Papeterie* 48, 666(1926); *Paper Trade J.* 85, No. 5, 57-8(1927).—By impregnating with $\text{Al}(\text{OAc})_3$ soln. and then drying at a low temp., the AcOH is driven off and the hydrated Al_2O_3 remains as a somewhat gelatinous, coherent film, which waterproofs and hardens the paper. At higher temps. the Al_2O_3 is completely dehydrated and becomes pulverulent.

A. PAPINEAU-COUTURE

Notes on the examination of decayed papier mâché fire buckets. A. C. THAYSEN AND H. J. BUNKER. *J. Soc. Chem. Ind.* 46, 382T(1927).—Exptl. evidence is given showing that the deterioration of papier mâché fire buckets is due solely to the activity of microorganisms. When microbiological action can be eliminated by addn. of anti-septics (e. g. PhOH) the life of such buckets can be almost indefinitely extended.

A. PAPINEAU-COUTURE

Study of clays used in paper making. W. V. TORREY. *Paper Industry* 9, 949-51(1927).—The viscosities of water suspensions of different grades of English china clays were found to vary through a considerable range. The rate of settling seems to be related to viscosity of clay "slips," those with highest viscosity being the slowest to settle. On the whole, coating grade clays settle more slowly than filler grade clays. The viscosities of the "slips" may be varied through a wide range by addn. of suitable reagents, starch and Na silicate being most efficient in reducing the viscosity, so that mixts. contg. 60% clay are rendered thin enough to be readily pumped through pipe lines. The viscosity of clay-casein mixts. is affected materially by addn. of modifying agents to the slip before mixing with casein soln.; sol. oil, alum, Na_3PO_4 and Na_2CO_3 increase the viscosity, while $\text{Ca}(\text{OH})_2$, starch and Na silicate decrease it. The changes in viscosity effected by the use of modifying agents with the clay are less marked when satin white is present than in a mixt. contg. clay and casein only.

A. PAPINEAU-COUTURE

Colloidal chemistry in paper making. RUDOLF LORENZ. *Bumazhnaya Promishlennost* 6, 88-93(1927); *Paper Trade J.* 85, No. 12, 56-8(1927).—A discussion showing that paper making is essentially a physico-capillary and colloidal-chem. process.

A. PAPINEAU-COUTURE

The significance of hydrogen-ion concentration in the manufacture of paper. H. ROSCHIER. *Pappers-Och Travarutidskrift for Finland*, 1927, No. 13, 446-50; *Pulp Paper Mag. Can.* 25, 1165-6(1927).—A discussion of the mechanism of foaming of stock, bringing out the action of alum, gelatin or other colloids on rosin soap and the high foaming properties of sulfite liquor or bleach liquor residues in stock.

A. P.-C.

Pink coloration of esparto papers. JAMES STRACHAN. *World's Paper Trade Rev.* 88, 114(1927); *Paper Mill* 50, No. 35, 34(1927).—The 3 factors in the production of pink coloration of esparto papers are presence of residual ligneous matter in the pulp, partial chlorination of this residue during bleaching, and introduction of S in some form. Though the exact nature of the pink coloring matter is unknown, it is almost certainly an oxidation product of a sulfonated ligneous compd. The following precautions will entirely prevent the trouble: (1) boil the esparto well and evenly; (2) maintain a basic action during bleaching to prevent liberation of HClO or Cl_2 ; (3) do not use antichlors and wash the pulp thoroughly with fresh water after bleaching. When low-soda boiling is adopted to increase the yield of pulp, bleaching and washing should be followed by treatment with 0.5-1% of Na_2CO_3 to destroy the chlorination compds. which may have formed.

A. PAPINEAU-COUTURE

The loading of paper. ANON. *Boll. staz. sper. indust. carta; Papeterie* 49, 201-5(1927).—The tests described lead to the following conclusions: retention decreases with increase in diln. of the stock; addn. of increasing amts. of $\text{Al}_2(\text{SO}_4)_3$ first lowers retention, then increases it to a max., after which it again slowly decreases; retention increases as the acidity due to $\text{Al}_2(\text{SO}_4)_3$ is neutralized and reaches a max. for a pH value of 5.6; when the amt. of $\text{Al}_2(\text{SO}_4)_3$ is increased, the pH being kept const., the retention

first declines, then increases to a max. with about 6-8% $\text{Al}_2(\text{SO}_4)_3$, and finally decreases again; retention is increased by addn. of rosin size (provided the p_H is not lowered below the optimum by addn. of $\text{Al}_2(\text{SO}_4)_3$), by addn. of water glass (especially when used in conjunction with rosin size), by hydration of the stock by beating, by addn. of NH_4OH , and by increase in the size of the particles of filler; addn. of starch soln. does not increase retention; tale gives a higher retention than china clay. A. PAPINEAU-COUTURE

Vegetable parchment. Some curious phenomena. JAMES SCOTT. *Paper Maker and Brit. Paper Trade J.* 74, 155-6 (1927).—A brief description of the prepn. and properties of vegetable parchment or "transparent paper," of the differentiation between vegetable parchments made from cotton and from wood sulfite, and of the microscopical appearance of parchment prepd. by increasingly drastic treatment with H_2SO_4 .

A. PAPINEAU-COUTURE

Effect of atmospheric humidity on the moisture content of paper. T. D. JARRELL. *Paper Trade J.* 85, No. 3, 47-51 (1927).—The amt. of H_2O absorbed and lost by 50 samples of com. papers of different grades exposed successively in air of 35, 50, 65, 80, 65, 50, 35, 50, 65, 80, 65, 50, 35, 65 and 35% relative humidity at 70° F. was detd. The results show that the H_2O content of the paper is appreciably higher at 50 and 65% relative humidity when these conditions are approached from a high humidity (80%) than when approached from a low humidity (35%). Some samples of paper of the same class show a wide difference in H_2O content. Paper contg. groundwood, rope or sulfate pulp contains more H_2O at a given humidity than paper made of all rag, coniferous wood (sulfite), broad leaf wood, or a mixt. of these. News print has a higher and blotting paper a lower H_2O content than any of the other classes of paper tested. Expts. on the rate of absorption and loss of H_2O when paper is transferred from an atm. of 35% relative humidity to one of 65% at 70° F., and then back to 35% humidity showed that H_2O is absorbed more rapidly than it is lost. In general, under the conditions of the expts., 48 hrs. are required for the attainment of equil. when the paper was transferred from 35 to 65% relative humidity, and about 6 days when it was changed from 65 to 35% humidity.

A. PAPINEAU-COUTURE

Expansion of paper with varying humidity. R. C. GRIFFIN. *Paper Trade J.* 85, No. 5, 51-4 (1927); cf. Davis, C. A. 17, 878.—A description of a modified form of the Davis "expansimeter," of the technic of its use, and of the results obtained with it in the examn. of a no. of different grades of papers.

A. PAPINEAU-COUTURE

Constant humidity (paper) testing room. H. T. RUFF. *Paper Trade J.* 85, No. 8, 50-1 (1927).—A detailed description of a small const. humidity and const. temp. room developed in the lab. of the Mead and Pulp and Paper Co., Chillicothe, Ohio, designed to give satisfactory regulation at a moderate cost.

A. PAPINEAU-COUTURE

Manufacture of paper-hangings. CARL HAGBERG. *Industriidningen Norden* 56, 49-53 (1927).—An illustrated review.

C. A. ROBAX

Study of the Mullen paper tester. LEO W. SNYDER. *Paper Trade J.* 85, No. 5, 55-7 (1927).—Comparative tests with new and worn rubber washer clamps and with all-metal clamps showed the latter to be superior. A change from rubber to all-metal clamp will lower the bursting values obtained, while reducing the area of the aperture in the base plate and clamping head will raise the values; and it is suggested that a definite reduction in area be established such that the net result of the 2 changes will be 0.

A. PAPINEAU-COUTURE

Measuring, sampling and testing pulp and paper mill wastes. W. L. STEVENSON. *Paper Trade J.* 85, No. 6, 54-6 (1927).—A description of the various methods of measuring and sampling paper mill effluents, with a brief outline of the analytical technic to be used in testing them and the method of expressing the results.

A. P.-C.

Developments in the Finnish groundwood, pulp and paper industry. ANON. *Papir-Journalen* 15, 143; *Pappers och Travarutidskrift for Finland*, June 15, 1927.—A resumé of the developments of individual companies during 1926.

C. E. P.

Literature review. ANON. *Papir-Journalen* 15, 146 (1927).—A list of 54 recent articles of interest to the pulp and paper industry including Scandinavian, German, American and Canadian publications.

C. E. PETERSON

The moisture equilibrium of egg-case fillers, flats and pads. S. D. WELLS. *Paper Trade J.* 85, No. 14, 56-7 (1927).—The leading points demonstrated in tests reported are as follows: (1) Egg-packing material came to H_2O equil. in an unheated warehouse in a period of about 48 days, only 14 days being required to bring it to 90% of its final H_2O content. (2) Under typical cold storage conditions the time required to come to equil. was only 2 weeks. (3) Approx. twice as much H_2O was held by the material under the cold storage conditions as when at equil. in the unheated warehouse. (4) Lime-cooked straw and spruce groundwood had practically the same H_2O content when

in equil.; Nu-Process stock (Rue and Monsson, *C. A.* **19**, 3591; W., *C. A.* **20**, 2072) contained 3% less. (5) The pack contg. the least H₂O was the combination of cupped flats and Nu-Process fillers; the 1st on account of their low wt. and the 2nd because of their relatively low attraction for H₂O. (6) The H₂O content of this combination at equil. in cold storage was 12 oz. as compared with 15 oz. with white fillers, flats and pads.

A. PAPINEAU-COUTURE

Chemical and physical properties of non-ferrous castings (FRANCIS) **9**. The recovery of volatile solvents by chemical washing (WIESENTHAL) **13**. The oxidation of organic dyestuffs and cellulose under the influence of light (SCHARWIN, PAKSCHWER) **25**. Substances accompanying cellulose (HESS) **11D**. Stream pollution in Wisconsin (BAKER, *et al.*) **14**. Purifying liquids [with sulfite waste liquor] (Swed. pat. 63,515) **13**. Filter for solutions for artificial silk manufacture (U. S. pat. 1,643,299) **1**.

HUNTER, DARD. **Primitive Papermaking**. Chillicothe, Ohio. Dard Hunter Limited edition of 200 signed and numbered copies; \$75. Reviewed in *Paper Trade J.* **85**, No. 9, 56(1927); also in *Pud* No. 11, 49-50.

HERZBERG, W.: **Papierprüfung. Eine Anleitung zum Untersuchen von Papier**. 6th ed. Berlin, 1927; Julius Springer. 168 pp. 27 RM. Reviewed in *Paper Trade J.* **85**, No. 10, 50(1927).

SCHUBERT, MAX: **Die Praxis der Papierfabrikation**. 3rd ed. Enlarged and revised by E. H. Ernst Mueller. Berlin: M. Krayn. 183 pp. Reviewed in *Pulp Paper Mag. Can.* **25**, 1010(1927).

WECHERT: **Buntpapier-Fabrikation**. Berlin: Carl Hofmann G.m.b.H. 30 RM. Reviewed in *Paper Makers' Monthly J.* **65**, 287 9(1927), *Paper Trade J.* **85**, No. 5, 51(1927).

High α -cellulose fiber. G. A. RICHTER and M. O. SCHUR. U. S. 1,643,417, Sept. 27. Unbleached sulfite pulp is treated with a soln. of Cl₂ insufficient in quantity to effect complete bleaching, boiled with a suspension of lime, and further boiled with addn. of a soln. of NaOH. Cf. *C. A.* **20**, 3566.

Cellulose acetate and nitrate solutions. J. G. DAVIDSON. U. S. 1,644,417, Oct. 4. Solns. of cellulose acetate adapted for use as lacquers for metals are prepd. with ethylene dichloride, ethylene glycol monoethyl ether and a glycol acetate or other solvent for cellulose acetate having a higher b. p. than the ether used. U. S. 1,644,418 specifies the use of a monoethyl ether of propylene glycol. U. S. 1,644,419 specifies the mixture together of toluene and the monomethyl ether of ethylene glycol. U. S. 1,644,420 specifies a compn. contg. cellulose nitrate and ethyl glycol, suitable for use in lacquer.

Sausage casing of cellulose hydrate, etc. WM. F. HENDERSON. U. S. 1,645,000, Oct. 11.

Dyeing cellulose acetate. I. G. FARBENING A. G. Brit. 262,830, Dec. 14, 1926. Cellulose acetate "silk" is dyed with azo dyes by the development process in the presence of a compd. of the urea group, e. g., in the presence of urea and CH₂O. A full color is obtained with 2,2-hydroxyvinyl-4-aminohydroquinone dimethyl ether developed with diazotized 4-chloro-2-toluidine. Other examples also are given.

Treating sodium sulfite cellulose waste liquor. E. L. RINMAN. Swed. 63,295, June 21, 1927. The waste liquor obtained in boiling cellulose with a soln. of Na₂SO₃ or NaHSO₃ or both is evaporated after sepn. of certain of the substances present in the raw liquor. The residue is burned in such a way that the Na compds. are converted into Na₂S or Na₂S and Na₂CO₃. The residues after the burning are dissolved in water, treated with one or more oxides of metals whose sulfides are insol. in NaOH soln. the Na₂S thus being converted into NaOH. After sepn. from the ppt. the Na₂S soln. is treated with SO₂ for the production of fresh cooking acid. Cf. *C. A.* **21**, 3969.

Charging cellulose digesters. S. SVENSSON. Swed. 63,340, July 12, 1927. A supplement to Swed. 62,160. Aced features.

Pulp. G. A. RICHTER. Can. 274,416, Oct. 4, 1927. Raw cellulosic materials are digested in an acid sulfite cooking liquor in which the free SO₂ and combined SO₂ are in approx. equal proportions of 3-4% each, under conditions of high temp. and pressure. The resultant pulp is sepd. from the spent liquor of digestion and is treated at low temp. with an NaOH soln. contg. a small proportion of bleaching agent. The treated pulp is washed free of its alk. liquor and the entrained products of reaction, and is then bleached. Cf. *C. A.* **21**, 3478.

Refining alkaline pulp. G. A. RICHTER. Can. 274,417, Oct. 4, 1927. Chem.

wood pulp is treated in a liquor contg. bleach and an excess of NaOH for a period of time sufficient to remove the non- α -cellulose constituents but insufficient to effect a substantial mercerization of the α -cellulose content.

Device for drawing off the rosin from the sand-catchers in the cellulose manufacture. A. W. NILSSON and J. BJUR. Swed 62,787, April 13, 1927. Mech. features.

Charging cellulose digesters. S. SVENSSON. Swed 62,460, Feb. 22, 1927. Mech. features.

Device for scattering the chips when charged into cellulose digesters. T. C. OLIN. Swed. 63,252, June 28, 1927. The current of chips passing down into the digester is given a rotary motion.

Blowing the digester contents into the washer. F. I. F. GÖTHNER and E. A. I. BRMELL. Swed. 62,919, May 3, 1927. The so called rising (foaming) of the mass when blown into the washer, caused by the lowered pressure, is avoided by cooling the mass during the transportation from the digester to the washer.

Manufacture of pyrocatechol and other phenols, acids and oils from cellulose waste liquors. K. H. A. MELANDER and J. H. WALLIN. Swed. 62,831, April 27, 1927. Pyrocatechol and other phenols, AcOH and other fatty acids, adipic acid, etc. and oils produced from liquors obtained by boiling wood, straw, etc. with acid or alk. solns. by heating the liquor together with alkali in closed vessels at suitable temp. and pressure. The free oils are partly blown off during the boiling, partly skimmed off the alk. soln. after the boiling has been accomplished. Then the soln. eventually after sepg. mother amt. of oils, methanol, acetone, etc., by distn. is acidified with CO_2 , SO_2 or another acid and after filtration the phenols and org. acids are obtained in known ways.

Celluloid. I. G. FARBERNIND. A. G. Brit. 263,076, Dec. 21, 1925. Celluloid-product such as those obtained as described in Brit. 247,174 (*C. A.* 21, 650) are acid with softening agents such as esters of glycolic, acetic, oxalic and phthalic acids, with hardening agents such as chloral or C_2Cl_6 .

Cellulosic product. M. CUSIN and P. A. A. CHEVALET. Can. 273,733, Sept. 6, 1927. A cellulosic product for the manuf. of artificial textile or plastic substances is obtained by treating cellulose first with HCO_2H and a small percentage of H_2SO_4 , and then treating the product with a mixt. of AcOH and H_2SO_4 in large proportion, both reactions being effected in the cold.

Modification of cellulose for the manufacture of cellulose acetates. M. CUSIN and P. A. A. CHEVALET. Can. 273,732, Sept. 6, 1927. A modified cellulose for the manuf. of cellulose acetates is obtained by treating cellulose with a mixt. of 80% HCO_2H and 20% H_2SO_4 in the cold.

Pulp refining and viscose process. G. A. RICHTER. Can. 273,847, Sept. 13, 1927. The viscose process of treating pulp in the production of viscose consists of soaking purified pulp in a bath contg. a soln. of NaOH, removing the pulp therefrom and expressing excess NaOH soln. therefrom. The raw pulp is purified for such soaking treatment by the expressed NaOH soln.

Apparatus for spinning artificial silk. SOIERIES DE STRASBOURG SOC. ANON and BRONNERT. Brit. 262,874, Sept. 21, 1925.

Paper pulp. C. R. ROBINSON. U. S. 1,644,447, Oct. 4. In order to sep. the fibers from paper pulp, a soln. of Na peroxide is added to the pulp to render it alk. to litmus and the mixt. is heated somewhat above atm. temp.

Paper pulp. H. A. SMITH. U. S. 1,644,451, Oct. 4. Pulp is bleached and jordaned to convert part of its cellulose into cellulose hydrate; the resulting product is passed through a hot starch soln., pressed and dried. This treatment serves to facilitate the production of "grease-proof" papers.

Paper pulp. B. S. SUMMERS. U. S. 1,643,826, Sept. 27. Pulp is formed by digestion with bisulfite liquor contg. H_3PO_4 ; the spent liquor is treated with lime, pptd. as phosphate is sepd. and H_3PO_4 is recovered from it, *e. g.*, by reaction with H_2SO_4 . *C. A.* 20, 3568.

System for drying paper or other materials. J. E. ALEXANDER. U. S. 1,645,366, Nov. 11. Superheated steam of approx. uniform temp. is maintained in a chamber surrounding the material and variable degrees of "conc'n. of heat" are applied to material in the drying chamber which are regulated by elec. heaters.

Opaque markings on transparent paper. K. S. MACLACHLAN. U. S. 1,645,249, Nov. 11. An opaque paper is made on a Fourdrinier machine and rubber or water marks are produced on it while passing through the machine; the paper is then subjected to a super-calendering operation at such a pressure as to render the paper transparent and the markings opaque.

Bleaching paper pulp. OTTO KRESS. U. S. 1,645,061, Oct. 11; Can. 274,563,

Oct. 11. Sulfate or kraft pulp is subjected to the action of a Cl bleaching agent and then to the action of a sulfite. *

Sorting apparatus for paper pulp. J. M. SPANGENBERG. Swed. 62,325, Feb. 1, 1927.

Suction box for paper machines. F. E. BERRY. U. S. 1,644,867, Oct. 11.

Insulating paper. H. FRIEDLÄNDER. Brit. 262,828, Dec. 14, 1925. In making pliable, waterproof paper or millboard or the like, hard waxy substances are added to the pulp in the beating engine or edge runner mill. Montan wax, carnauba wax and coumarone resin may be used together. Resin sizes, fillers and artificial phenol resins also may be used.

Paper-making apparatus. R. E. HEISEL. U. S. 1,643,657, Sept. 27.

Paper-making apparatus. C. W. UNKLE. U. S. 1,644,620, Oct. 4.

Portable air nozzle for paper-making apparatus. FRANK BEDARD. U. S. 1,644,226, Oct. 4.

System for continuous feeding and mixing of paper pulp or like material with bleaching agents. C. B. THORNE. U. S. 1,643,566, Sept. 27.

Self-supporting lining for Jordan-engine shells. A. L. BOLTON. U. S. 1,643,368, Sept. 27.

24 - EXPLOSIVES AND EXPLOSIONS

CHARLES E. MUNROE

Report of the Chief Inspector of Explosives of Victoria for 1926. REG. J. LEWIS. *Pamphlet* 10 pp. Melbourne, Australia, 1927; cf. C. A. 20, 3570.—The chief explosives manufd. and imported are of the gelatin dynamite class. All black powder, blasting as well as sporting, is imported and constitutes about $\frac{1}{4}$ of the total. As 10 licenses were issued to manuf. Rack-a-rock and Lithyte, explosives which are made at the firing ground as wished for use, the proportion of black powder is probably less than above stated. It appears that in Australia, as elsewhere, black powder, which was practically the only explosive in use for over 500 years, is rapidly being displaced by modern explosives. All of the 11 accidents recorded were of a minor character, most of them occurring in the "bullying" with gelignite. This process, known in this country as "springing" or "chambering," consists in detonating small charges of a high explosive in a bore-hole through which to enlarge the cavity at its lower end, which is then filled with the charge for the final blast. Accidents occur from this last charge as it is being fed into the borehole becoming ignited by incandescent or heated particles of the "bullying" charge left in the cavity.

CHARLES E. MUNROE

Tritol (trinitrotoluene) as an explosive. R. GIOVETTI. *Notiz. chim.-ind.* 430-2(1927); cf. C. A. 21, 3129.—Descriptive information and data of importance with diagrams and illustrations.

C. C. DAVIS

Hydrogen peroxide explosives. M. BAMBERGER AND J. NUSZBAUM. *Z. ges. Schiess-Sprengstoffw.* 22, 125-8(1927).—Mixts. of H_2O_2 (60% soln.) with powd. *para* formaldehyde are brisant explosives which detonate on heating or under the influence of a blasting cap. The mixt. also detonates spontaneously when left for a short time in contact with Pb, presumably from evolution of heat from oxidation of the Pb. Crystals, m. 50° , were sepd. from the mixt. and found to have a high degree of sensitiveness and brisance. Forty g. cellulose (either cotton or wood pulp), treated with 200 g. of 83.4% H_2O_2 , forms a viscous, gelatinous mass, 10 g. of which was detonated in a Trauzl Pb block with a No. 8 cap, giving a net expansion of 408-414 cc., as compared with expansions of 390-400 cc. for tetranitroaniline, 320-340 cc. for dynamite, and 245 cc. for TNT. The new explosive burns without detonation when dropped in a red hot crucible or ignited by flame, is relatively insensitive to friction or shock, and has an ignition temp. of $194-208^\circ$. It must be prepd. shortly before use, as bubbles resulting from decompn. of the H_2O_2 are evolved on standing, and the mass hardens. After 48 hrs. the Trauzl test dropped to 349-371 cc. Data given concerning actual blasting trials in rock indicate very satisfactory performance in both drill hole and mud-capped shots.

C. G. STORM

New possibilities in the production of nitroglycerin. ARNOLD SCHMID. *Z. ges. Schiess-Sprengstoffw.* 22, 169-73, 201-6(1927).—An app. and method for the continuous nitration, sepn. and washing of nitroglycerin are described, with illustrations.

C. G. STORM

Quantitative stability tests of smokeless powder. J. C. A. SIMON THOMAS. *Z. angew. Chem.* 40, 991-2(1927).—Four g. of powder, ground to pass 0.5-mm. mesh, are

ated in a glass-stoppered glass tube 160 mm. long and 18 mm. internal diam. in an l bath held at 104–6° for double base, at 109–11° for single base smokeless powder. he glass tubes are first heated open for 8 hrs. to drive out H₂O and volatiles. Good nokless powders should not lose more than 2% in wt. during the first 8 hrs. Various mples were also heated continuously for 5 days. Tables show that double base powders ithout stabilizers do not stand up, also that a small addn. of vaseline does not suffice t a small addn. of dimethyldiphenylurea (centrallit) or NaHCO₃ is sufficient to make e powder stand the test. Larger amts. of vaseline produce powders just as stable e those with centrallit, although no chem. but merely a phys. stabilizing action must e assumed with vaseline in that it closes the pores of the powder and prevents access H₂O and air. A stable single base powder can be produced from good raw materials d without stabilizer, but small quantities of diphenylamine are desirable.

H. M. SYMMES

Inflammability of hydrogen. IV. Influence of dimethyl selenide and dimethyl lluride on the limits of inflammability of hydrogen-air mixtures. YOSHIO TANAKA ND YŌZABURŌ NAGAI. *Proc. Imp. Acad. (Japan)* 3, 348–51 (1927); cf. *C. A.* 21, 3130.— y the addn. of about 1% of either Me₂Se or Me₂Te, the upper limit of inflammability f H is lowered from 71 to about 43; further addn. causes a more gradual decrease. e₂Se, Me₂Se and Et₂Se all have the same theoretical flame-propagation temp., 1750°.

Influence of tetramethyl tin and tetramethyl lead on the limits of inflammability f hydrogen-air mixtures. *Ibid* 434–6.—The upper limit of H is lowered from 71 to 4% by the addn. of 0.125 mol. % of Me₄Sn; further addn. gradually lowers it, until mol. % gives a value of 38.5%; 0.50 mol. % of Me₄Pb lowers the upper limit from 1 to 54, but further addn. raises the upper limit, 2.50 mol. % giving a value of 59%. he lower limit of H is little influenced by the addn. of 0.5% of Me₄Sn or Me₄Pb, but further addn. decreases the lower limit. The theoretical flame-propagation temp. f Me₄Sn and Me₄Pb is 1680°.

C. J. WEST

Some factors influencing the ignition of carbon monoxide and oxygen. A. K. BREWER. *Proc. Nat. Acad. Sci.* 13, 689–94 (1927).—By the use of inductances to vary he peak c. d. in the circuit of a heavy condensed discharge igniting an explosive mixt.

CO and O, it was found that the mechanism of the ignition at a const. pressure as independent of any particular stage of ionization produced in the spark. This as true for moist and dry gases. Ignition at const. pressure is dependent upon the nergy of the spark, and not upon voltage, but ignition points at varying pressures epend upon voltage. Addn. of water vapor lowers the ignition voltage. A, N, O₂, EtOH, Et₂O, CHCl₃ and isopropyl nitrite, being inert in the explosion except as they bsorb energy, increase the ignition potential. H, CS₂, EtOH and Et₂O are themselves xidized in the explosion, and lower the ignition potential. The combustible vapors ise the ignition voltage unless enough O is present to burn them.

R. J. H.

Least energy required to ignite the mixture of air and the vapors of ethyl ether. ZABURŌ NAGAI AND MINAO FURIHATA. *Proc. Imp. Acad. (Japan)* 3, 352–4 (1927).— e least energy required to ignite mixts. of air contg. from 2.50 to 6.65% Et₂O at 100, 1 and 200 v. is reported in a table and as curves. This energy (at 100 v.) decreases idly for Et₂O concns. of 2.5 to 3.9%, remains const. from 3.9 to 4.7%, increases denly at 4.8%, remains const. from 5 to 5.9% and then increases again. When voltage of the condensers is raised, the concn. range of the 1st horizontal stage xtended on both sides, resulting in the narrowing of the range of the 2nd horizontal ge, until finally the latter stage vanishes when the condensers are charged up to 1 v. When the pressure is reduced, the least energy for ignition is increased.

C. J. WEST

Effect of ethyl bromide on the least energy required to ignite the mixtures of air i the vapors of ethyl ether. Y. NAGAI AND M. FURIHATA. *Proc. Imp. Acad. (Japan)* 355–60 (1927).—The least energy for ignition increases with the amt. of EtBr added, ept for the mixts. poorer in Et₂O, for which the least energy decreases owing to the ring of the lower limit of inflammability.

C. J. WEST

Innovations in the methods of blasting with liquid air. HEYER. *Kali* 21, 237–40 (27).—Recent economical developments in the mining of rock salts with liquid cartridges are outlined. Illustrations of equipment are given.

D. THUSEN

Factors which influence the quality of safety fuse. FRANJO KOBEVAR. *Z. ges. heiss-Sprengstoffw.* 22, 93–5, 139–41 (1927).—The chief factors governing the unity in rate of burning were found by many tests to be the compn. and quality of the ck powder, conditions and time of storage, quality of jute and method of spinning, iency of impregnation with asphaltum, and atm. influences. Increasing the KNO₃ tent of the powder increased the rate of burning, while addn. of graphite causes

an opposite effect, as does also increase in moisture content or in d. of the powder.

C. G. STORM

Explosions caused by oil vapor. EDWARD INGHAM. *Power* **66**, 400(1927).—Such explosions may occur in crank cases as a result of over-heating at the cross-head guides. The liability to these accidents can be reduced by use of suitable oils and by restricting the quantity of lubricant to a min.

D. B. DILL

Cordite factory explosion. ANON. *Chem. Age* (London) **17**, 255(1927).—This explosion, which killed 3, occurred Sept. 10, 1927, in a stove of the Me₂CO recovery plant of the Royal Naval Cordite Factory, Holton Heath, Dorset, while workmen were dismantling the plant and as the last joint of the coil for carrying off the Me₂CO was being unscrewed. Although the temp. of the stove is kept down to 45° to avoid nitroglycerin evapn., some does volatilize and condense in the pipes. As the pipe had sagged at this joint it is believed nitroglycerin collected there and was exploded by friction as an attempt was made to unscrew the joint.

CHARLES E. MUNROE

The equilibria of tetranitromethylaniline in certain binary systems (IPREMOK, TIKHOMIROVA) **2**.

Blasting cartridges for use with liquid carbon dioxide, etc. D. FARRELL and A. W. HELMHOLTZ. *Brit.* **262**, 941, Dec. 15, 1925.

25—DYES AND TEXTILE CHEMISTRY

L. A. OLNEY

New dyes derived from acenaphthene. T. J. TAPPEY. *Textile Colorist* **49**, 521-5 (1927).—Attempts to condense *acenaphthenequinone* (I) with 2,3-diaminoanthraquinone (II) by glacial AcOH or H₂SO₄ were not successful. The condensation of I with 3-aminoanthraquinone by means of AcOH and NaOAc, AcOH and Zn dust, EtOH, Zn-Cl₂, or anhyd. AlCl₃, also all failed. Condensation of *naphthalic anhydride* (III) with II in glacial AcOH gave a brown vat dyestuff (IV). Nitration of IV gave a red vat dyestuff of good fastness to Cl. On condensing 1 mol. of III with 2 mols. of resorcinol a yellowish brown acid dyestuff (VI) is formed. Bromination of VI gave a magenta acid dyestuff (VII). Nitration of VI gave a seal-brown acid dyestuff (VIII). Reduction of VIII gave a greenish black acid dyestuff. Condensation of 1 mol. of I with 2 mols. of resorcinol gave a tan acid dyestuff (IX). The bromination product of IX is similar to VII but duller. VI appears to be faster to light than fluoresce. When VI is coupled to sulfanilic acid an olive dyestuff results. By using III in place of the usual phthalic anhydride, as in the prepn. of fluoresce, fluorescent dyestuffs were produced. A dyestuff resembling Violamine B was produced from VI. Fusion of *naphthalimide* with KOH gave a pink vat dyestuff (V). On treating V with concd. HNO₃ a green acid dyestuff results, probably by oxidation.

CHAS. E. MULLIN

The method of production of blue hydrone dyes. E. ORLOV AND M. KACHURIN. *J. Chim. Ukraine* **2**, *Tech. Teil* 65-73; *Chem. Zentr.* **1926**, II, 2634-5.—By following the patent directions, several hydrone dyes were synthesized; the conditions of prepn. and the dyeing properties are described. In conclusion the analysis of Na₂S according to the method of Podreschetnikov is surveyed. Its basic reactions are: Na₂S + H₂O → NaOH + NaSH and NaSH + HCHO + H₂O → NaOH + HOCH₂SH. The NaOH formed in both stages is titrated with HCl to phenolphthalein.

C. C. DAVIS

Yellow dye from the wood of Cochlospermum. C. D. MELL. *Textile Colorist* **49**, 555-6(1927).

CHAS. E. MULLIN

Vat dyes on acetate silk-cotton unions. C. E. MULLIN. *Can. Colorist* *Textile Processor* **7**, 190-2, 208-9(1927).—The formulas used in applying the vat dyes to the cotton of acetate silk-cotton unions are given, with dyeing formulas for white and two-color effects in unions.

CHAS. E. MULLIN

Sulfur dyes on wool-cotton mixtures. WALTER WARREN. *Textile Colorist* **49**, 470(1927).—Methods and formulas are given.

CHAS. E. MULLIN

Fastsol dyestuffs on viscose and cuprammonium silk. ANON. *Am. Dyestuff Rept.* **16**, 521-2(1927).—Lists of colors and methods of dyeing are given.

L. W. R.

A study of certain amino derivatives of acridine and some related compounds. SAMUEL MEEKER. *Textile Colorist* **49**, 447-51(1927).—In a study of the influence of acridine and some related compds. upon the color and properties of azo and other

dyestuffs *m*-, *o*- and *p*-nitrobenzoic acids and acridyl benzoic acid (I) were prepd. By suitable steps I was converted into the amino compd. (II) and coupled in alk. soln. with various components. The compd. of II with II acid is sol. and when applied as an acid dyestuff gives a pure purple color. The chromotrope acid compd. forms a reddish brown soln. which cannot be used as an acid or basic dye. With Neville-Winther salt II gives a sol. green acid dyestuff. The Schaeffer salt compd. gives a strongly fluorescent blue to yellow soln. which acts very slightly as an acid dye. The R salt compd. gives a blue to yellow soln. but is not suitable as an acid or basic dyestuff. The croceine salt compd., while sol., is not suitable as a dyestuff. With F salt II gives a greenish brown soln. sensitive to acids, only slight dyeing action. With J acid II gives an insol. blue compd. The 1-amino-8-naphthol-2,4-disulfonic acid compd. is sol., giving a strongly fluorescent red to brown soln., and in an acid bath dyes a light brown color. The 1-naphthol-3,8-disulfonic acid compd. with II is a sol. red or brown fluorescent salt which is almost decolorized by the addn. of acid. It dyes wool a light cream color. The 1-naphthol-3,6,8 trisulfonic acid compd. gives a red to brown fluorescent soln. The naphthol BS compd. is insol. CHAS. F. MULLIN

The oxidation of organic dyestuffs and cellulose under the influence of light. W. SCHARWIN AND A. PAKSCHWER. *Z. angew. Chem.* 40, 1008 10(1927).—Different org. dyestuffs on cotton or paper were sealed in glass tubes with the gases O_2 , NO , N_2O , CO , CO_2 , H_2 or N_2 and exposed to sunlight or to light from a quartz Hg lamp. The speed of bleaching decreased in the order of the gases named. None was observed in the tube with N_2 and generally none with H_2 , although in the latter case, very decided changes, due to reduction, sometimes took place. On exposure to moist air, the reaction was reversible. The changes due to oxidation were of course not reversible. In those tubes contg. O_2 , NO or N_2O , CO_2 was always present in the gases after exposure to sunlight. The work was interrupted at this point by the war. It was resumed on a much larger scale. The investigation was extended to more substrates, such as pieces of porous clay plate, in addn. to cellulose. Ten g. samples were used, and the amt. of dye applied was detd. Each sample was sealed in a special tube with pure dry O_2 and exposed to sunlight for 4 months. The CO_2 in the gas was detd. with $Ba(OH)_2$. In every case, CO_2 was found. It was surprising to note that in those cases where cotton was the substrate, the quantity of CO_2 was much greater than with the clay substrate. Undyed cotton exposed under the same conditions showed the presence of considerable CO_2 . Filter paper and cellulose sealed in tubes contg. O_2 and exposed to the quartz Hg lamp at a distance of 40 cm. for 3 hrs. also showed the presence of CO_2 . The CO_2 in the tubes with the cotton substrate therefore has 2 origins, the oxidation of the dyestuff and, probably more important, the oxidation of the cellulose. After exposure, the fiber was found to have lost a considerable part of its tensile strength, the undyed material more than the dyed, and to show the reactions attributed to oxycellulose. Other carbohydrates, including starch and sugar, were exposed for 3 hrs. and a positive test for CO_2 was obtained. The work is being continued. RUBY K. WORNER

Notes on the indigosols. F. PETERHAUSER. *J. Soc. Dyers Colorists* 43, 251-3 (1927).—Lists of dyes and methods of their use are given. L. W. RIGGS

Indigosol colors in cotton piece dyeing. D. S. NAVLOR. *Dyer, Calico Printer* 58, 32-3(1927).—Several formulas are given and the application of these dyestuffs is discussed. The indigosols do not dye dead cotton. C. E. MULLIN

Formulas for 1927 fall shades on chrome-tanned side leather. *Woolen Dyestuffs* 28, 76-7(1927). CHAS. E. MULLIN

The theory of dyeing processes. LIGON RUD. *Festschrift 100-jähr Besteh. Tech. Hochschule Karlsruhe* 1925, 490-6; *Chem. Zentr.* 1926, II, 2632-3, cf. *C. A.* 20, 3574.—From the point of view that both phys. and chem. processes play a mutually important role in dyeing, the dyeing of wool with acid and basic dyes was investigated. Special attention was directed to the part played by the p_H value of the bath during the dyeing. The action of crystal violet on wool results in an increase in the p_H value of the bath after the dyeing, because of liberation of H ions from the wool into the soln. This independent of the concn. of the dye or of the quantity of the dye taken up by the wool. The initial value of p_H depends upon the initial concn. of the dye, while the final value of p_H is independent of both the concn. of the dye and of the quantity of wool. Contrary to the data of Briggs and Bull (*C. A.* 17, 1149), the quantity of dye taken up from soln. by the wool does not depend directly upon the p_H value of the bath. With acid dyes the alk. of the bath is greater after the dyeing, but here too there is no relation with the quantity of dye absorbed. Measurements of p_H during the action of acid and of alkali solns. on the same kind of wool showed that wool absorbs H ions from solns. which are more acid than p_H 4.6, whereas the wool liberates H ions in solns. having a

p_H value over 4.6, with accompanying decompn. of the wool substance. At p_H 4.6 the H-ion concn. does not change on account of reactions between the wool and the soln., and at this p_H the wool is not decompd. The analogy between this phenomenon and the behavior of amphoteric electrolytes at the isoelec. point allows the assumption that the value p_H 4.6 is a mean value for the isoelec. points of the several amphoteric substances comprising the wool substance of the particular grades of wool examd. In any case the wool with its wool substance takes an active part in the dyeing process and does not behave as an adsorbent in the classic meaning of the term, which involves reversibility, and therefore a purely phys. conception of the dyeing process appears to be inadequate. C. C. DAVIS

Dyeing of hosiery containing mixed fibers. W. A. EDWARDS AND G. F. HARD-CASTLE. *J. Soc. Dyers Colorists* **43**, 249-51(1927).—Directions are given.

L. W. RIGGS

Three methods of dyeing silk hosiery. W. C. DODSON. *Dyestuffs* **28**, 86-9 (1927).—The two-bath, the one-bath and the acid methods are described

CHAS. E. MULLIN

Dyeings for heavy overcoatings. ANON. *Dyestuffs* **28**, 113-4(1927).—Suitable dyestuffs are suggested.

CHAS. E. MULLIN

Dyeing striped effects on worsteds. L. J. MATOS. *Dyestuffs* **28**, 117-8(1927).—Dyestuffs suitable for white stripe effects of cotton, rayon or silk in worsteds are suggested.

CHAS. E. MULLIN

Dyeing wool and silk mixtures. A. FLEMMING. *Dyestuffs* **28**, 38-41(1927).—Methods are given.

CHAS. E. MULLIN

Dyeing silk and wool mixed goods. ANON. *Dyestuffs* **28**, 53-4(1927).—Formulas and dyestuffs are suggested

CHAS. E. MULLIN

Dyeing heavy woolen goods. G. A. STEWART. *Dyer, Calico Printer* **48**, 16-7 (1927).—Dyestuffs and formulas are suggested.

CHAS. E. MULLIN

Essentials in dyeing cotton warp woolen fabrics. GEORGE RICE. *Am. Dyestuff Rept.* **16**, 608-10(1927).—In the process of dyeing, which is described, the essentials emphasized are the use of soft water, and the avoidance of the use of nearly spent baths.

L. W. RIGGS

Boiling-off, weighting and dyeing of silk. L. J. MATOS. *Dyestuffs* **28**, 33-4 (1927).—Methods and formulas are given.

CHAS. E. MULLIN

Weighting and dyeing of silk. ANON. *Dyestuffs* **28**, 68-9(1927).—Dyestuffs are suggested.

CHAS. E. MULLIN

Dyeing silk with sulfur colors. FREDERICK GROVE-PALMER. *Am. Dyestuff Rept.* **16**, 615-6(1927).—To protect silk from the action of weak alkali and to prep. the fiber to receive a S dye, the dye liquor is made up with a soln. contg. 150 g. Na_2CO_3 per l. to which is added one l. of 50% lactic acid. The details of dyeing a batch of goods are given.

L. W. RIGGS

Dyeing silk and viscose mixtures. GEORG RUDOLPH. *Rayon J.* **2**, No. 4, 15-7, 45-6(1927).—Suitable dyestuffs and application methods are given for solid and two-color effects.

CHAS. E. MULLIN

Skein dyeing of viscose rayon. W. M. SCOTT. *Dyestuffs* **28**, 81-3(1927).—A list of direct dyestuffs is suggested for application at 88° in the presence of soap.

CHAS. E. MULLIN

Dyeing rayon with naphthol AS. H. LINT. *Rayon J.* **2**, No. 5, 26, 45(1927).—A discussion with a method.

CHAS. E. MULLIN

Dyeing of viscose, etc., and wool mixtures. WM. BENNETT. *Silk J.* **4**, No. 38, 55, 57(1927).—Dyestuffs and formulas are suggested.

CHAS. E. MULLIN

Dyeing of cotton-silk fabrics with direct cotton dyestuffs. T. M. HARRIS. *Textile Colorist* **49**, 540-3(1927).—General. Dyestuffs are suggested.

CHAS. E. MULLIN

Four methods for developing acid dyeings on wool. J. H. WALKER. *Textile Colorist* **49**, 544(1927).—Treatment with dichromate, CrF_2 , alum and CuSO_4 are described.

CHAS. E. MULLIN

Bleaching and dyeing jute. WALTER WARREN. *Textile Colorist* **49**, 398-9(1927).—Formulas and methods are given.

CHAS. E. MULLIN

Dyeing horse hair. ANON. *Dyestuffs* **28**, 43(1927).—Dyestuffs and formulas are suggested.

CHAS. E. MULLIN

Dyeing of neps. L. G. LAWRIE. *J. Soc. Dyers Colorists* **43**, 294-5(1927).—The differences in appearance between neps are not merely due to differences in light reflection from flat surfaces. The internal structure of the immature fiber which forms neps is different from that of the mature fiber. S colors as a class and basic colors give better results in dyeing neps than do direct cotton dyestuffs. So far no connection

has been found between chem. constitution, mol. wt., or diffusion factors of the dyestuff and its power of covering neps. L. W. RIGGS

Uneven dyeings of cotton. ANON. *Dyestuffs* 28, 54, 63-4(1927).—Cotton from various sources and of different types should not be mixed in the same goods where the most even results are desired. CHAS. E. MULLIN

Locating responsibility for unevenness. ANON. **Dyestuffs* 28, 100-3(1927).—The various causes of unevenness are discussed. CHAS. E. MULLIN

Lake making. L. J. MATOS. *Dyestuffs* 28, 93-5(1927).—Dyestuffs and methods are suggested. CHAS. E. MULLIN

The indigo plants of southern Mexico. C. D. MELL. *Textile Colorist* 49, 467 (1927). CHAS. E. MULLIN

Elimination of fog in dye houses. C. D. GRAHAM. *Textile Colorist* 49, 473-4 (1927). CHAS. E. MULLIN

Production and operating costs of a roller cloth dryer and carbonizer. A. C. NIELSEN CO. *Textile Colorist* 49, 554(1927).—Costs are given on a Proctor & Schwartz dryer. CHAS. E. MULLIN

Vigoureux printing of textiles. GEORGE RICE. *Am. Dyestuff Rept.* 16, 523-4 (1927).—A description of the process is given. L. W. RIGGS

Bleaching artificial silks. JOHN NOLAN. *Textile Colorist* 49, 469(1927).—General. CHAS. E. MULLIN

Machine sizing of rayon. R. P. MORNINGSTAR. *Rayon J.* 2, No. 3, 33, 53(1927).—Application and drying conditions are discussed. CHAS. E. MULLIN

Delustering rayon. K. M. HERSTEIN. *Rayon J.* 2, No. 4, 13-4, 45; *Silk J.* 4, No. 37, 60—A discussion of the delustering of acetate and the other rayons. The older rayons are usually delustered with Al soaps or BaSO₄, but the use of chloroacetic acid or pectin has been suggested. CHAS. E. MULLIN

Treating rayon for knitting. R. P. MORNINGSTAR. *Rayon J.* 2, No. 4, 30-1, 46 (1927).—Lubrication of the fibers is described. CHAS. E. MULLIN

Chitin and chitin silk. G. KUNIKE. *Kunstseide* 8, 182 3; *Chem. Zentr.* 1926, II, 2129.—The chem. behavior of chitin is discussed. If purified chitin is dissolved in acids, a thread can be spun wet or dry, which has a round or heart-shaped cross-section and a tensile strength of 35 kg. per sq. mm., whereas the tensile strength of cellulose silk is only 25 kg. per sq. mm. In appearance the pale lustrous threads resemble acetate silk and real silk. Films of chitin of large size are also transparent and show high resistance to creasing. The production of material for the chitin goods offers no difficulties. C. C. DAVIS

The chemical analysis of cotton. The effect of the disruption of the cotton hair on the extraction of fat, wax and resin. R. G. FARGHER AND LUCY HIGGINBOTHAM. *J. Text. Inst.* 18, 283-7T(1927); cf. *C. A.* 18, 1753.—The effect of destroying the structure of the material is to facilitate the extn. of substances which are otherwise removed slowly and not to make accessible substances protected from attack by their position within the hair (cf. *C. A.* 17, 2507-8). The effect is considerably smaller than indicated by Knecht and Street. Since treatment with acids prior to extn. causes loss of part of the fatty material, a single extn. is impracticable. Extn. of the gray or gray-soured cotton and then of the tendered material gives a total ext. equal to that obtained by triple extn. by Knecht and Street. RUBY K. WORNER

Effect of light on colored cotton fabric. I. EVA HIBBERT. *J. Soc. Dyers Colorists* 43, 292-4(1927).—Expts. showed that the destruction of color in calico dyed with direct colors occurred quite independently of any reducing action by cellulose in the presence of light. It is possible to obtain isatin from indigo-dyed cotton by oxidizing the color on the fiber with KMnO₄ in 7.5% H₂SO₄. It is shown that the destruction of indigo on cotton by the action of light is due to the oxidation of the color to isatin. L. W. RIGGS

Mechanical air equipment for coloring textiles. WM. BREWSTER. *Textile Colorist* 49, 545-7(1927).—Spraying app. are described. CHAS. E. MULLIN

Action of sodium perborate on cotton and linen cellulose in the presence of catalyzers. Y. DALSTRÖM. *Svensk Kem. Tid.* 39, 141-56(1927).—German summary. The stabilizing effect of Na₂SiO₃ on perborate is apparent, not real; it does not appear in distd. water. The catalytic action of Cu salts is not as inorg. Cu but in some org. combination with cellulose. The action of Cu on the cellulose → oxycellulose in perborate solns. is effectively inhibited by Na soaps when Na soap : perborate = 1:1 for linen and 1:3 to 1:5 for cotton. If the perborate concn. in laundry fluids is such that the solns. are never satd. at 97° the O₂ will confine its action to bleaching the fabric. Part of this article is polemic. A. R. ROSE

The role of moisture in the absorption and hydrolytic action of acids in non-aqueous solvents on cotton. I. **Hydrogen Chloride in toluene.** F. C. WOOD AND ERNEST BUTTERWORTH. *J. Soc. Chem. Ind.* **46**, 375 ST(1927). The action of concns. of HCl between 0.1 and 0.6% in anhyd. toluene on scoured or gray cotton yarn contg. various amts. of moisture is described. The absorption of HCl from toluene by cotton is practically complete after 10 min. at 25°. The amt. is dependent upon the water content of the cotton. For concns. below 28%, HCl, the tendering is dependent upon the concn. of the aq. acid and not on the proportion present, but in 28% HCl solns., it is dependent upon the ratio of cotton to sat'd. aq. soln. In no case was phys. alteration in the direction of parchmentization or dissolution effects observed. The tendering was greater with the scoured yarn. RUBY K. WORNER.

Experimental yarn-sizing plant and some results obtained with it. G. B. NEW. *J. Textile Inst.* **18**, 301-19T(1927). An apparatus specially constructed for the prepn. of sizes and their application to the yarn is described. It consists of a water jacketed boiler and a small scale sizing machine, so constructed that all variables can be regulated. The effects of the concn. of starch, its nature, amount, and temp. of cooking, and of the addn. of fats, waxes, oils, etc., were studied. The concn. of starch gives a proportional increase in the protective power in most cases. Above a certain temp. starches expand, was found, above which starches do not expand. Above a certain temp. limit, specific for each starch and well below 100° C., temp. has no appreciable effect. The time factor is also measurable within the range of 1 hour to 6 hrs. In this work, a standard temp. of 100° and standard time of 1 hr. were generally adopted. With the exception of glycerol which increases the protective power, a film of various fats and oils to the size decreases its protective power. HCl, however, the fats and oils are applied to the surface of the yarn after it has been sized and dried, the wear-resisting power is improved. Of the materials examined, paraffin wax and stearin were the most powerful protective agents. RUBY K. WORNER.

Introduction to a study of wool. CHAS. E. MULLIN. *Can. Colorist Textile Processors* **7**, 230, 238(1927). Introduction to a study of wools upon the constitution of wool. CHAS. E. MULLIN.

Synthetic resins and their application to textile materials. A. J. HALL. *Dye Calico Printer* **58**, 6-7(1927). At present does not find very little use in the textile industry but it is possible that in the fut. they may find use in finishing, resisting and printing textiles. CHAS. E. MULLIN.

After-treatments of cotton yarn and fabric. T. H. HARRIS. *Textile Colorist* **49**, 471 2(1927). Sizing and finishing materials are considered. C. E. M.

Stencilling. HARRY WATSON. *Textile Colorist* **49**, 396-7, 468-9(1927). A general discussion of stencilling as applied to textile materials. CHAS. E. MULLIN.

The relation between tanning agents and vegetable dyes (FREUDENBERG) 26. Production of photographic images on cellulose acetate film (HALL, HILL) 5. A photographic method of investigating the color of light sources, and the reflecting power of colored fabric (CUNLIFFE, FARROW) 2. Detergent action of soaps (VINCENT) 27. Determining Cu in chemically treated cloth (BONNARD, LIBMAN) 7. Halochromism and deep colored ketones (WIZINGER) 10.

Dyes. T. G. FARENHED. A-G. *Brit.* 262,819, Dec. 11, 1925. Dibenzanthrone dyes are obtained by treating *h,h'*-dibenzanthronyls with alk. condensing or reducing agents. Several examples are given for the production of dyes giving blue and red-violet shades on cotton from the vat. The starting materials can be obtained by treating halobenzanthrone with metal powders or by boiling diazobenzanthrones in the presence of Cu_2Cl_2 , or by oxidizing benzanthrone in acid soln.

Dye. H. WAGNER and A. FUNK. U. S. 1,611,003, Oct. 4. A greenish yellow monoazo dye is formed from diazotized 4-chloro-2-nitroaniline and acetoacetic chloroanilide.

Isodibenzanthrones. PAUL NAWIASKY, OTTO BRAUNSDORF and EDUARD H. ZAPFEL. U. S. 1,644,819, Oct. 11. By heating 2-methoxy-3,3'-benzanthracenyl sulfide with a mixt. of caustic alkali and alk. a dye of the isodibenzanthrone series is obtained which dyes from a pure blue vat pure bluish violet shades.

Isodibenzanthrones. HEINRICH NERESHEIMER. U. S. 1,644,850, Oct. 11. About equimol. proportions of benzanthrone-3-thio-*p*-cresyl ether or other benzanthrone-3-thio ether having a free 2 position and a benzanthrone having free 2- and 3-positions such as benzanthrone or 6-chlorobenzanthrone are heated with Na and alk. or other alk. condensing agent in the absence of O.

7-Keto-7-meso-benzanthrone-3-sulfinic acid. HEINRICH NERESHEIMER and HANS EMMER. U. S. 1,644,851, Oct. 11. 3-Chloro-7-meso-benzanthrone in MeOH is treated with aq. NH_3 and Na hyposulfite and the product after distn. of the MeOH dissolved in hot H_2O (with aeration) and acidulated. Other similar reactions are described.

Indigo. D. G. ROGERS. U. S. 1,644,493, Oct. 4. In production of indigo by the caustic fusion of indigo-yielding substances, the fusion is carried out with the addn. to the reaction mixt. of kerosene oil b. above 240° or other petroleum hydrocarbon material which is liquid at ordinary temps. and serves to reduce the quantity of alkali required.

Apparatus for piece dyeing. T. J. BACHOFEN. U. S. 1,644,460, Oct. 4.

Piece dyeing. T. J. BACHOFEN. U. S. 1,644,461, Oct. 4. Shrinkage is controlled by winding the goods in spaced layers and maintaining them in stretched and wound condition while the wound goods as a unit are subjected to operations such as boiling, bleaching, dyeing and drying.

Apparatus for piece dyeing. T. J. BACHOFEN. U. S. 1,644,462, Oct. 4.

Dyeing silk. I. G. FARBENIND. A.-G. Brit. 263,088, Dec. 21, 1925. Silk is dyed with mixts. of vat and azo dyes by impregnating with a 2,3-hydroxynaphthoic amide or a compd. contg. a reactive CH_2 group, together with a vat dye which has been dissolved by a usual method; the vat dye is then oxidized in insol. form and the azo dye is formed by treatment with a diazo component. Raw silk can be degummed either during or after the dyeing process. Examples are given. Cf. C. A. 21, 2565.

Apparatus for dyeing yarn, etc. BRITISH COTTON & WOOL DYERS ASSOCIATION, LTD., E. A. BARKER and F. ELLISON. Brit. 262,909, Nov. 21, 1925.

Color prints by the dye transfer process. R. VON ARX. U. S. 1,643,529, Sept. 27. Most mordant dye images are used for printing purposes in intimate contact with copy sheets or layers such as collodion which have greater affinity for the dye used than that of the material of the mordant printing images.

Acid sulfuric acid ester compounds of aromatic hydroxyalkyl ethers. W. HENTRICH and M. HARTTMANN. U. S. 1,644,524, Oct. 4. The K salt of the acid H_2SO_4 ester of 3-nitromethylbenzene-4-ethylene glycol ether or other compds. of the probable general formula, $\text{aryl-O-aryl-O-SO}_2\text{-OX}$, in which X stands for H or a salt-forming basic residue and which are dye intermediates, are formed by processes including treating aromatic hydroxyalkyl ethers with concd. H_2SO_4 at room temp.

Dye pole (with steel tube and hard rubber jacket) for drying artificial silk, yarn, etc. E. S. TEED. U. S. 1,643,594, Sept. 27.

Degumming silk. I. ZO WALLERSTEIN. U. S. 1,644,764, Oct. 11. Silk is subjected to the action of papain or other proteolytic enzymes of the type which is active in a neutral or in a slightly alk. or slightly acid medium, at a temp. not less than 50° .

Printing textile fabrics. I. G. FARBENIND. A.-G. Brit. 262,987, Feb. 11, 1926. Fabrics are printed with a mixt. of an alkali salt of a coupling component suitable for producing azo dyes on the fiber and a salt of an aromatic sulfo-nitrosaminic acid. On treatment with an acid, azo dyes are developed on the fiber. Numerous details and examples are given. Aromatic sulfamic acids are obtained by condensing aromatic amino compds. with aminosulfonic acid. Aromatic sulfo-nitrosaminic acid salts are obtained by treating aromatic sulfamic acid salts with nitrite and acid and neutralizing with caustic alkali.

Protecting textile materials from chemical action and increasing their strength. A. MEYER-SANSBOEUF GES. Brit. 263,102, Dec. 21, 1925. Materials such as cotton, artificial silk, flax, hemp or jute are protected from the action of substances which destroy cellulose and their strength is increased by treatment with 3 successive baths having a tanning, mordanting and oiling action, resp. Several examples are given.

Sizing composition for textile yarns and threads. C. F. RILEY and G. A. AW-COOL. Can. 274,638, Oct. 11, 1927. A sizing compn. consists of a salt of a resinous acid, a fatty lubricating agent and a soap of a fatty acid. Can. pat. No. 274,639 specifies a sizing compn. consisting of a preponderating quantity of resin and subordinate quantities of a fatty lubricating agent and a soap of a fatty acid.

Testing strength of fibers. E. E. CHANDLER. U. S. 1,643,333, Sept. 27. Fibers such as cotton are arranged parallel to each other, wrapped with a thread to obtain the superficial area of the bundle and to prep. it for an even break, and the bundle is then broken to det. its strength.

Moth-proofing fabrics. L. E. JACKSON and H. E. WASSELL. Brit. 263,092, Dec. 17, 1925. Woolen fabrics, furs, feathers, etc., are treated with a soln. of a cinchon alkaloid or a salt of such an alkaloid, e. g., with a naphtha soln. of quinine oleate which may be used for dry-cleaning.

Apparatus for preparing fibers of ramie or other materials for spinning. J. DE-LENS, I. SOF and A. NICHOLAS. *Bril.* 262,815, Dec. 12, 1925.
Fulling mill. R. J. WILSON. U. S. 1,645,210, Oct. 11.

26—PAINTS, VARNISHES AND RESINS

A. H. SABIN

Determining the covering capacity of paints. V. V. KOLCHEV. *Trans. Russ. Inst. Applied Chem.* 1925, No. 4, 27-33.—A comparative study of glass and metal as objects for the detn. of the covering capacity of paints. Glass is more suitable for this purpose, as the absorption of light is more easily detd. J. S. JOFFE

Casein as binding medium for pigments. E. O. RASSER. *Kunststoffe* 17, 197-8 (1927).—The prepn. of paints with casein solns. as binding medium for the pigments is described. When properly prepd. such paint possesses an enormous binding power, the colors obtain the highest luminosity, the keeping quality is unlimited and it is most convenient and cheap in use D. THUSEN

Examination of water-line (marine) paints. M. RAGG. *Farben-Ztg.* 31, 1795-8 (1926); cf. Figg, C. A. 20, 994.—R. discusses the results of Figg's expts. on boot-topping paints applied on iron objects and exposed at the water line. J. SCHALCH

The chemistry of satin white. P. FUCHS. *Chem.-Ztg.* 50, 769-70 (1926).—Satin white is a mixt. of gypsum and Ca aluminate (5/2) with small quantities of $\text{Ca}(\text{OH})_2$. It is formed by the action of $\text{Ca}(\text{OH})_2$ on the basic Al sulfate of the formula $[\text{Al}_2(\text{OH})_2(\text{SO}_4)_2, \text{Al}(\text{SO}_4)_3]$, which contains 80-85% of the H_2SO_4 necessary to form the neutral salt. The reaction proceeds in two steps, which are characterized by the viscosity of the reaction mass: formation of gypsum, product little viscous; formation of Ca aluminate, product very viscous. An explanation for the failure to obtain a satin white of suitable consistency by using the neutral Al sulfate instead of the basic product is that in the first case 6 mols. CaSO_4 and no H_2O , in the latter only 5 mols. CaSO_4 and one mol. H_2O per 2 mols. Ca aluminate are formed. The high CaSO_4 content and the absence of reaction H_2O are chiefly responsible for the failure in making satin white of a suitable consistency from neutral Al sulfate. J. SCHALCH

Testing methods for turpentine, used in the chemical industry. G. AUSTERWEIL. *Chem.-Ztg.* 51, 249-51 (1927).—For the manuf. of camphor and perfumes genuine turpentine oil is used which should satisfy the following tests. Absence of water. Turpentine mixed with 2-3 parts benzene should not become turbid. Acidity: The acid number, detd. in the usual way, should be below one. Carbohydrates: Tests for carbohydrates should be negative. Test for α - and β -pinene: $[\alpha]$ should not be higher than $\alpha/D \pm 39^\circ 50'$ which is the value for $[\alpha]$ of α -pinene. Inactive or β -pinene, having half the rotating power of α -pinene, lowers the above figure. Distn.: About 500 g. of turpentine, dried for 24 hrs. over anhyd. Na_2SO_4 , is distd. in an app. consisting of a one-l. flask, charged with Ca filings or china splinters, and a Lebel-Henninger five-bulb or a Vigreux column, 35 cm. long. Five fractions of 100 cc. are collected which should distil between 153.5° and 165° at 760 mm. and should amount to 90% of the total. The sp. grs. of the fractions should lie between 0.862 and 0.874 and n between 1.4625 and 1.4755. The residue, amounting to 10%, is steam-distd. The distillate should show within a limit of 10% the same $[\alpha]$ as the original turpentine oil. J. S.

Collection of crude turpentine and resin in the Landes department of France. K. MARY HUTCHIN. *Pharm. J.* 119, 245-7 (1927); cf. Lendner, C. A. 21, 2071.—A descriptive account, illustrated by photographs. S. WALDBOTT

Lead poisoning in an enameling plant. W. S. LEATHERS and HUGH J. MORGAN. *J. Am. Med. Assoc.* 89, 1107-12 (1927). L. W. RIGGS

"Anime" resin, and constitution of so-called copal. HERMANN KUNZ-KRAUSE. *Pharm. Ztg.* 72, 1124-5, 1142-3 (1927).—A discussion of the terms and products. W. O. E.

Lake making (MATOS) 25. Synthetic resins and their application to textile materials (HALL) 25. Analysis of lithopone (REMINGTON) 7. Separating crude shellac solutions or other liquids from suspended matter centrifugally (U. S. pat. 1,644,492) 13. Cellulose acetate and nitrate solutions (U. S. pat. 1,644,420) 23.

Paint finishes. C. H. EGGLEHOFF. U. S. reissue 16,760, Oct. 4. See original pat. 1,600,723; C. A. 20, 3580.

Titanium pigment. L. E. BARTON and L. W. RYAN. Can. 274,070, Sept. 20, 1927. A concd. aq. suspension of CaSO_4 is added to a Ti soln. and the charge boiled to pptn. of the Ti. The soln. is filtered to sep. the ppts., which are calcined.

Reflecting metal coatings. LAMPEN- UND METALLWAREN-FABRIKEN R. DITMAR GEB. BRUNNER AKT.-GES. Brit. 262,827, Dec. 14, 1925. Flexible backing material is impregnated with a binder such as resin, shellac, celluloid or gum which softens under heat when applied by pressure to the foundation plate to which the metal coating has first been applied. The surface of a celluloid backing may be made viscous by glacial HOAc and a metallic coating united with the viscous surface by heated rollers. Electrolytic coatings also may be used.

Dissolving and bleaching shellac. F. C. RAWOLLE. U. S. 1,644,491, Oct. 4. Lumps of plastic crude shellac are treated with a continuous flow of a dissolving fluid such as Na_2CO_3 soln. and after being transiently held from being carried along by the current of fluid are released by the cutting of the lumps into smaller subdivisions which are subjected to violent agitation to effect soln. Undissolved material is returned for retreatment. An app. is described.

Ink. HERMANN SCHLADERBACH and HERBERT HAHLE. U. S. 1,645,117, Oct. 11. An ink suitable for writing comprises an azo dye which dyes cotton directly and a free alk. substance such as NaOH in sufficient quantity to render writings produced with the ink fast to H_2O .

Artificial resin. E. C. ROSSITER. Can. 274,738, Oct. 18, 1927. A condensation product of urea and thiourea with CH_2O is produced by separately condensing urea with CH_2O and thiourea with CH_2O so that the products are left in soln., mixing the 2 solns. together and concg. the soln. so obtained by evapn.

Phenol-methylene resins from alcohol and methylals. C. B. CARTER. U. S. 1,645,226, Oct. 11. A phenolic compd. such as PhOH is boiled at substantially atm. pressure together with methylal and a quantity of H_2SO_4 or other suitable inorg. acid in excess of 10% of the reaction mixt.

27—FATS, FATTY OILS, WAXES AND SOAPS

E. SCHERUBEL.

Composition of the body oil from sperm whale. I. Fatty acids. YOSHIYUKI TOYAMA. *J. Soc. Chem. Ind. Japan* 30, 519–27 (1927).—The oil prepd. exclusively from the body blubber of sperm whale (*Physeter macrocephalus* L.) is orange-yellow and deposits at ordinary temp. a considerable amt. of cryst. solid: d_4^{20} 0.8806, d_4^{30} 0.8733, n_D^{20} 1.4620, acid value 1.24, sapon. value 131.6, I value 82.4, unsaponif. matter 36.40% and fatty acids 64.13%. The fatty acids are orange-yellow and liquid at ordinary temp., having d_4^{20} 0.8918, d_4^{30} 0.8847, n_D^{20} 1.4602, n_D^{30} 1.4564, neutralization value 199.2, sapon. value 201.8, I value 87.4 and Et_2O -insol. bromides 5.55%. The fatty acids consist of about 10% satd. and 90% unsatd. acids. The latter consist for the most part of the acids of the oleic series; the acids more unsatd. than those of the oleic series are present in a few %. Myristic, palmitic, stearic acids and a small quantity of arachidic acid form the satd. acids; palmitic acid is preponderant. Lower satd. acids with less than 14 C atoms, which contain most likely lauric acid together with lower members, are also present in a small quantity. The acids of the oleic series contain zoomaric and oleic acids, an acid $\text{C}_{20}\text{H}_{38}\text{O}_2$, and cetoleic acid. An acid $\text{C}_{14}\text{H}_{26}\text{O}_2$ is also present in small quantity. Lower members of the oleic series with less than 14 C atoms are absent or present only in minute amt. The acids more unsatd. than those of the oleic series are in addition to C_{22} acids also C_{20} and C_{18} acids. The presence of clupanodonic acid, $\text{C}_{22}\text{H}_{34}\text{O}_2$, is confirmed. No evidence is obtained for the presence of physeteleic acid exhibiting the properties stated by Hofstädter (*Ann.* 177 (1854)) and Tsujimoto (*C. A.* 15, 2006); this is an impure zoomaric acid.

II. Unsaponifiable matter. *Ibid* 527–32.—The unsapon. matter is yellow and forms at ordinary temp. a cryst. solid: d_4^{20} 0.8508, d_4^{30} 0.8413, n_D^{30} 1.4550, sapon. value of acetylated product 186.6, I value 72.2 and cholesterol content (by digitonin method) 0.41%. It consists chiefly of oleyl alc. (octadecenol), cetyl alc. and octadecanol, of which oleyl alc. is preponderant. It contains also small quantities of more unsatd. acls. than oleyl alc., among which highly unsatd. acls. giving Et_2O -insol. bromides are found. Besides these acls., cholesterol is present. Hexadecenol is absent or present in minute amt. Tetradecanol was not detected. Oleyl acetate, b_p 217–20°, yields,

on oxidation with KMnO_4 in AcOH soln., monoic acid and acetylhydroxynonoic acid; from this the constitution of oleyl alc. should be $\text{Me}(\text{CH}_2)_7\text{CH}:\text{CH}(\text{CH}_2)_7\text{CH}_2\text{OH}$, which is identical with that of the alc. from liver oil of *Chlamydoselachus anguineus* Garman. K. K.

Application of adsorptive carbons to crude vegetable oils. J. P. HARRIS. *Oil Fat Ind.* 4, 329-30(1927).—By treating crude coconut oil contg. 5% free fatty acid in the cold with adsorptive C, the neutralizing loss has been reduced to 5.5%; such results are consistent with varying % of free fatty acids. Two large-scale tests were made with cottonseed oil, as follows. The oil was first filtered and then 0.25% of adsorptive C together with 0.25% of diatomaceous earth added and the mixt. agitated at 28° for 30 min. The oil was then filtered again. In the 1st test untreated crude oil contg. 2.9% free acid was refined with 10% of 15° B. NaOH; there was a loss of 8.1%. Carbon-treated crude oil refined with the same amt. of NaOH lost 5.95%. In the 2nd test untreated crude oil contg. 3.54% free fatty acids gave a refining loss of 10.60%. With carbon-treated crude the loss was 7.10%. The refined oil from the C-treated crude was lighter and brighter without any further treatment than the refined and bleached oil from the untreated crude. The deodorizing time of the C-treated crude was reduced 45 min. per batch. E. SCHERUBEL

The behavior of fish oils with uranium nitrate and pyrogallie acid. W. H. DICKHART. *Oil Fat Ind.* 4, 326 8(1927).—The following test is proposed: Place 10 mg. of $\text{UO}_2(\text{NO}_3)_2$ and 3 cc. of the fish oil in a test tube and heat on a steam bath for 20 min., shaking occasionally. Remove and observe the color, which should be as follows: U. S. P. cod-liver oil, amber, showing a greenish cast with transmitted light. Norwegian sperm oil, light amber color, no change with transmitted light. Menhaden oil crimson. Pilchard oil, light red. Whale oil, light brownish red. Herring oil, blood-red. Sardine oil, blood red. Newfoundland cod oil, blood-red. Samples of cod-liver oil answering all U. S. P. requirements except that they were high in unsapon. matter gave a red coloration within 6 min. and were declared contaminated. E. SCHERUBEL

Detection of extracted olive oils. M. F. LAURO. *Oil Fat Ind.* 4, 324-5(1927).—The various tests for extd. oils are based on reactions with traces of solvents left in the oils after extrn. L. employs the following test. About 5 cc. of the oil is heated in a test tube to 150° and a pinch of BzOAg added and shaken. If any S-bearing solvent is present the oil will darken. The test has been found sensitive to 0.2% of olive-oil foots in a pressed oil. Neither the "com" nor "Pachini" test reveals this amt. The test may be made quant. by comparing the color produced against that shown by standards. E. SCHERUBEL

Determination of iodine-bromine values with potassium bromate and arsenite solutions. L. W. WINKLER. *Arch. Pharm.* 265, 554-60(1927).—With reference to the Ger. Pharm. method for detg. the IBV values of oils and fats, W. shows exptly. that instead of the prescribed alkaline arsenite soln., an acid reagent is better on account of its greater stability with respect to atm. O. Furthermore, an arsenite reagent of 0.25 N strength is preferable to one 0.5 N. Precise details are given for the modified procedure. W. O. E.

Determination of cold test on oils. T. A. FAUST, et al. *J. Am. Leather Chem. Assoc.* 22, 525 8(1927).—A discussion of proposed methods and their short comings. H. B. MERRILL

The determination of water in oils. H. PFLUG. *Chem.-Ztg.* 51, 717-8(1927).—P. modifies Oertel's method (*C.* 15, 768, 1410) as follows. Measure 25 cc. of the oil into a tube insulated in a porcelain beaker by Kieselguhr; stir the oil with a thermometer graduated into $\frac{1}{2}^\circ$, and note the temp. when it remains const. for 3 min. Add 10 g. of a mixt. of 2 parts anhyd. MgSO_4 and 1 part powd. quartz, stir and note the max. temp. Multiply the diff. between the 2 readings by 0.6 to obtain % H_2O . The factor 0.6 holds good for tar oils and petroleum, and is based on the heat of hydration to $\text{MgSO}_4 \cdot 7\text{H}_2\text{O} = 13.7$ cal. and the sp. heats of tar (0.5), anhyd. MgSO_4 (0.22) and SiO_2 (0.19). If the temp. increase is more than 13° , dil. the oil to be tested with 3 parts of a similar oil but free from H_2O , and multiply the result by 4. P. ESCHER

Determination of the acetyl number. F. CRONER. *Z. angew. Chem.* 40, 1013-4(1927).—C. suggests a modification in the method for detg. the acetyl no. as proposed by the German Com. for Standard Analyt. Methods in Fat Analysis, by transferring the sapon. residue after the alc. evapn. to a long-necked Kjeldahl flask with connecting bulb, in order to prevent the mechanical carrying over of H_2SO_4 during the following distn. of AcOH . P. ESCHER

Cacao-butter substitutes and their detection. A. W. KNAPP, J. E. MOSS and A. MELLEY. *Analyst* 52, 452-6(1927).—The only substitutes commonly present in

cacao butter appear to be coconut or palm-kernel stearin and the so-called illipé butters. As little as 5% of coconut or palm kernel stearin can be readily detected for, with pure cacao butter which is not rancid, neither the Reichert-Meissl nor the Polenske value exceeds 0.3. The so-called illipé butter used is not the true butter of this name but is more likely to be Borneo tallow and this has high iodine values and high Zeiss spectrometer values. The "titre" of the fatty acids of good cacao butter is 49-50°, whereas for Borneo tallow it is 54.6°. Other methods which have been recommended for the detection of adulterants are discussed and their limitations pointed out.

W. T. H.

Analysis of a mixture of olive oil and peanut oil. SIRO MARTINOLI. *Pharm. Acta Helv.* **2**, 15-8, 30-9, 54-9 (1927). (In Italian.)—A detailed exptl. study of the phys. and chem. consts. of a mixt. (the proportion not stated) of freshly expressed peanut oil and refined olive oil. The results are tabulated, compared in each case with recorded values of the single oils. (1) The phys. properties generally show increased values compared with the av. values of the components. (2) The chem. properties vary according to acidity or rancidity: the Reichert no., the abs. I no., acid no., sapon. no., increased; the Helmer no. and the relative I no. remain the same, while the mol. wt. diminishes. (3) Freshly expressed peanut oil seems to contain anhydrides and esters, on account of which the Ac no. is greatly increased. (4) The Ac no., therefore, cannot be considered a const., much less can it be a measure of the hydroxylated fatty acids, unless one succeeds in breaking down by chem. means the complex of the saponified fatty acids. (5) On account of (3), a certain relation exists between the Ac no. and the sapon. no.

S. WALDBOTT

Contribution to the study of cakes formed by the neutralization of oils. VIZERN and GILLOT. *Ind. chim. anal. chim. appl.* **9**, 257-61 (1927).—An interesting discussion of the chem. nature of oil cakes. It is recommended to det. (1) the % of total fatty matter in the cake, (2) the % of fat combined in the form of soap and (3) acidity of the cake.

W. T. H.

Hydrogenated squalene. MIKISAKI TSCHIMOTO. *Chem. Umschau Fette, Oele, Wachs u. Harze* **34**, 256-8 (1927).—The liver oil of Zamens, black shark, was hydrogenated on a semi-conv. scale over Ni catalyst. The product, "squalane," 46-47%, cont. 4.2 sapon. no. 82.8, I no. 1.2, unsapon. 51.43%. The fatty acids m. 58-59°, sapon. no. 177.5 and I no. 0.0. The unsapon. matter is light yellow, semi-solid, cont. 70% I no. 1.4. Besides $C_{30}H_{50}$, $C_{31}H_{52}$, the hydrogenated product contains fatty alcohols, which had been of iron schetyl ole. A distn. of 1000 g. of the hydro. oil at 3.4 mm. yielded 39% of a stillate at 236°, partly liquid and partly solid. A distillation and re-fraction of the stillate at 4.6 mm. over Na, there were obtained pure squalane, dodecahydro-squalene, with the following consts.: b_p 248°, b₁₀ 101.5°, n_D^{20} 1.48117, n_D^{25} 1.4739, mol. refraction, 136.2, viscosity Ostwald 15° 36.9, 25° 15.4, 35° 10.7, 40° 8.21 sec., 15° 321 sec., 30° 118 sec., flash p. Pensky-Martens 190°, density 0.89% loss after 6 hrs., readily sol. in ether, gasoline, $CHCl_3$, slightly sol. in acetone and glacial AcOH. Conc'd. H_2SO_4 at 70° is discolored but the squalane remains unchanged. Its low s. p. and its high b. p. and resistance toward air and squalane as a lubricant and transformer oil.

P. ESCHER

Hydrogenation of oleic acid by activated hydrogen. H. I. WATERMAN AND S. H. GRANN. *Chem. Umschau Fette, Oele, Wachs u. Harze* **34**, 255-6 (1927); cf. C. A. **1**, 66. Pure oleic acid, contg. 0.3 and 0.5% of satd. acids was hydrogenated in 3% with dry H_2 , activated by a silent discharge from a current of 7.5 amp., at 220 v., spark of 40 cm. in air. After 35-65 hrs. at 0.5-2.0 mm. pressure at 15-30° the product showed an I no. of 77.1-84.6, n_D^{70} 1.44221-1.4425, m. 31-35°, satd. 42-42°, with a mol. wt. of 305.5 and a m. p. of 69.9°. W. and B. conclude that hydrogenation was accompanied by some polymerization.

P. ESCHER

Oxidized fatty acids. D. POLLMANN. *Seifensieder-Ztg.* **54**, 602-4, 625-6 (1927).—From correct results in the analytical detn. of "hydroxy acids" by Fahrion's gasoline sol., it is essential first to saponify the fat, even when already in the form of free acids. The dark color of the acids usually appears on acidifying after sapon. The acids are more sol. in fatty acids and in ethyl esters of the acids than in their esters. Satd. acids may also become oxidized; Merck's stearic acid, contg. 5.9% of oxidized acid, after being heated for 16 days to 110° in a cotton-plugged flask, showed 15% oleic and 10% hydroxy acids, the latter of an I no. of 10.2 (= 11% oleic acid). Fe and Cu salts in the formation of dark substances, the color itself not being due to Fe. Fe and Al slightly favors development of color; the older the acids, the more rapid the darkening. Na salts of the oxidized acids are not easily salted out but salts

of true hydroxy acids like ricinolic and dihydroxystearic acid are readily salted out. Reduction of oxidized acids by P and HI in a sealed tube resulted in high viscosity, lighter-colored Na salts and ready sept. when salted out; they remained, however, insol in gasoline; hydroxy acids were absent. The whole phenomenon has the appearance of polymerization, forming high-molecular compds. that resemble fatty acids.

P. ESCHER

Linolic acid content of bone grease. H. STADLINGER AND E. TSCHIRCH. *Chem.-Ztg.* **51**, 667-9, 686-8, 706-8 (1927). The linolic acid was detd. by Kaufmann's thiocyanometric method. Weigh 8.4 g. Br into a 500-cc. flask, add 200 cc. CCl_4 and make up to 500 cc. with glacial AcOH (= soln. A), weigh 25 g. $\text{Pb}(\text{SCN})_2$ into a dry half-gal. glass-stoppered bottle and add 500 cc. glacial AcOH (= soln. B); transfer A into B very gradually with const. shaking; settle and filter into a glass-stoppered bottle. Standardize this approx. 0.1 N soln. of $(\text{SCN})_2$ by adding 25 cc. of it to 20 cc. 5% KI soln. and 50 cc. H_2O and titrate against 0.1 N $\text{Na}_2\text{S}_2\text{O}_3$. Weigh accurately into a glass-stoppered Erlenmeyer flask 0.1 to 0.2 g. of fat and add 25 cc. $(\text{SCN})_2$ soln. Let stand 24 hrs. Pour it into 20 cc. 5% KI soln., rinse with KI and titrate back against 0.1 N $\text{Na}_2\text{S}_2\text{O}_3$: % linolic acid (x) = $1.104(I-S)$; % oleic acid (y) = $1.112(2S-I)$; % satd. acids = $100 - x - y$. I = I no. of the fat, S = thiocyanometric I no. of the fat = cc. $\text{Na}_2\text{S}_2\text{O}_3$ absorbed $\times 1.27$ ÷ wt. of fat. Fresh bone grease from calf bones contained 4.6% linolic acid, from beef bones 4.2% and from household beef bones 5.6%. Test mixts. of bone grease with added linolic acid agreed within less than 1% with calcd. amts. Linolic acid detns. in commercial bone greases show that the grease must first be freed from lime soaps, etc., by an acid wash before comparable results can be obtained, and that the Kaufmann values and I nos. must be detd. on the grease, not on its fatty acids. The av. values are given as follows:

Grease	min	% Linolic acid max	mean	I no Hanus	Kaufmann value	No. of samples
Refined						
bone grease	7.5	10.8	8.9	54.1-60.4	46.9-52.4	8
Crude						
bone grease	5.4	8.6	7.3	53.6-59.2	48.4-51.6	4
Pure						
bone grease (lab. made)	5.0	5.7	5.2	46.5-59.3	42.0-54.7	3

P. ESCHER

Decomposition of vegetable waxes. A. MAILHE. *Bull. soc. chim.* [4], **41**, 1056-61 (1927); cf. *C. A.* **18**, 3284. Gradual heating of 200 g. of *carnauba wax* with 15 g. fused ZnCl_2 caused sapon. of the esters followed by decompn. of the acids and alcs., with production of fixed gases (not detd.), an oily distillate (63% of the original wax), and a carbonaceous residue contg. the ZnCl_2 , which is partially converted into oxychloride. The compn. of the fixed gases sampled at 260° and 280° (measured in the vapors) was: CO_2 0.40, 0.39; CO 0.61, 0.49; C_nH_{2n} 6.49, 5.64; $\text{C}_n\text{H}_{2n+2}$ 2.12, 2.67; CH_4 16.14, 15.67; H 73.32, 74.25; O 0.92, 0.89%, resp. The distillate consists of a mixt. of CH_4 and C_2H_4 -hydrocarbons, up to and including paraffin (m. 56-8°), but free from aromatic and naphthenic hydrocarbons. As the temp. of decompn. increases, the proportion of C_2H_4 -hydrocarbons increases and of unsatd. decreases. Similar results are obtained with MgCl_2 instead of ZnCl_2 , but the reaction proceeds more slowly. Under the action of 10% fused ZnCl_2 *Japan wax* was decompd. in a manner similar to vegetable and animal oils and fats (*C. A.* **18**, 577). The gas sampled at 260° contained CO_2 4, CO 18.4, C_nH_{2n} 2.4, CH_4 27.3, H 46.9, O 0.1%. The distn. products are similar to those obtained from *carnauba wax*.

A. PAPINEAU-COUTURE

Free alkali in soaps. J. DAVIDSOHN. *Chem. Umschau Fette, Oele, Wachse u. Harze* **34**, 260 (1927); cf. *C. A.* **21**, 665. D. now modifies his method for detg. free alkali in soft soap, by decanting the alc. soap soln. from the Na_2SO_4 and washing the latter with abs. alc. and then titrating the soap soln., a sharper end point is claimed.

P. ESCHER

Soaps containing solvent. R. HUETER. *Seifensieder-Ztg.* **54**, 685-6 (1927).—The legitimate use in soaps of naphtha, tetralin, hexalin, etc., should not be restricted by fixing standards based only on the % of fatty acids. If only 1 or 2 of these solvents are present, sufficient data for quant. identification can be obtained by a steam distn. from its dil. acidified soln. and the sp. gr. of the distillate; if coconut oil is present, a titration of the distillate must be made to det. the volatile acids. If higher alcs. are present they must be salted out from the distillate by Na_2SO_4 , but even then butyl alc.,

for instance, retains 28% H_2O and must first be dried or extd. with petr. ether before correct sp. gr. or b. p. can be obtained. An acetyl no. of the distillate is of use when the nature of the alc. is known. The distillate may also be shaken out with ether to obtain gravimetrically the total solvent present. Non-volatile addns. like lanolin or spermaceti must be detd. from the insol. matter. A scheme is briefly outlined for the sepn. of most of the solvents that might be added to soaps. P. ESCHER

The behavior of soaps of various oils on dilution. H. B. STOCKS. *Oil Fat Ind.* 4, 315-19 (1927).—The pink color which develops with phenolphthalein in most soap solns. deepens as diln. is increased, but with castor-oil soaps only a faint pink was produced, which did not deepen on diln. On titrating soap solns. with standard acid it was found that the hydrolysis alkali increased up to a max. at a certain diln. (1 part soap in 150 parts H_2O); further diln. caused no change. With most of the soaps examd. the hydrolysis alkali amounts to 50% of the total, but castor-oil soap formed an exception, amounting to not more than 5% of the total. Expts. show that there is no appreciable hydrolysis in solns. of Na salts of fatty acids up to and including lauric acid, but after this there is a complete break, the hydrolysis alkali amounting to 50% of the total. Rosin acids behave similarly to fatty acids. The test suggested for distinguishing castor from other oils and detecting adulteration is as follows: Saponify 5 g. of oil with excess of alc. KOH under a reflux condenser, add phenolphthalein, neutralize with HCl and evap. the alc. Add H_2O to the residue and after soln. make up to 100 cc. Dil. 10 cc. (0.5 g. oil) to 250 cc. with boiled distd. H_2O and titrate with 0.1 N HCl, first with phenolphthalein and continuing with Me orange. With castor oil only about 0.5 to 0.8 cc. of 0.1 N acid was required in the 1st titration, whereas other fats and oils required 8 or 9 cc. Butter, coconut and palm-nut fats were exceptions, but the results are explainable by the presence of the lower fatty acids. Since 95% of the acids of castor oil are ricinoleic acid, it is evident that the salt of this acid does not hydrolyze to any considerable extent, and the difference in behavior between this and other soaps must be ascribed to this particular acid. E. SCHERUBEL

Detergent action of soaps. II. G. P. VINCENT. *J. Phys. Chem.* 31, 1281-315 (1927).—The solid particles held in stable suspension in a soap soln. possess a negative charge as the result of adsorption of ions from soln. The particle is also capable of adsorbing positive ions. If the ions are adsorbed equally no stable suspension is formed. Max. stabilization occurs at the soap concn. in which the negative ion is adsorbed most strongly in comparison with the positive. According to Fall (C. A. 21, 2811), this max. occurs at a soap concn. of 0.2-0.4%; according to McBain, at 4.45%. It was found that in the latter case, coarse non-stabilized C prevented the passage of the fine stabilized C through the filter. By preventing this interference, the result of McBain agrees with that of Fall. The cleansing of oils as an example of liquid dirt was studied. The soaps, Palm Oil, Olive Oil, Green Arrow, Silicated Green Arrow and Tallow, possess very nearly the same emulsifying powers. The necessary soap concn. is between 0.05 and 0.10%. Forty degrees is recommended as a convenient temp. Increase in temp. is detrimental to emulsification, whereas at room temp., the soln. is too viscous for proper and easy mixing. The addn. of alk. salts aids emulsification, undoubtedly because of the lowering of the surface tension of water toward oil in the presence of a soap soln. NaOH, Na_3PO_4 and NH_4OH are more efficient than Na_2CO_3 and borax. A soln. 0.32% in respect to NaOH, or 1.2% or more NH_4OH , is beneficial. NaOH or Na_3PO_4 in concd. soln. is detrimental. Na_2SiO_3 is of no value as an emulsifying agent. The detergent power of concd. soap solns. and of other solns. which are capable of removing oil without emulsification is ascribed to their "wetting" ability. Na_3PO_4 is of particular value as a detergent for greases contg. Ca soaps due to its ability to form Na soaps. NaOH is slightly less effective for grease contg. Ca soaps, but for a specific transmission grease examd., it was found a little superior to Na_3PO_4 . A detergent compd. contg. 20% soap and 80% Na_2SiO_3 had excellent emulsifying power. Such a product would probably increase the strength of cotton and reduce the amt. of free alkali. The amt. of shrinkage of wool caused by the mix was no greater than that caused by soap alone and the dye was less sol. Its effect as a water softener is considered. It is of extreme value for H_2O contg. Fe, of considerable value for H_2O contg. Mg, and of very little value for water contg. Ca. NaOH is more efficient than Na_2SiO_3 and Na_2CO_3 in softening H_2O contg. Fe. The beneficial effects obtained by adding Na_2SiO_3 to NaOCl bleach (cf. C. A. 20, 1143) are explained as follows: The strength of the bleaching soln. is conserved because the silicate retards the formation, and consequently the action, of HOCl. The increase in strength of the fiber is due to the adsorption of SiO_2 which strengthens the fiber to a greater extent than the bleaching weakens it. The color is improved because the presence of Na_2SiO_3 in the bleach aids in removing some slightly

yellow decompn. product, which otherwise is difficult to remove by washing. Exptl. evidence supporting the above views is given. RUBY K. WORNER

"Washed 511 times with Persil." B. WALTHER. *Seifensieder-Ztg.* 54, 623-5 (1927).—W. reports wash tests with "Persil" on fabrics half cotton and half linen, 40 metric threads 29×29 per sq. cm. The fabrics were immersed cold, brought to boiling, kept near 100° for 15 min., rinsed and squeezed. In 2 series of tests, after 50 washings the tensile strength of the cotton threads had decreased to 84.7 and 87.6%, its original value and that of the linen threads to 74.9 and 74.2% of the original value. These tests indicate that the 511 washings must have been made with special fabrics or under otherwise unusual conditions. P. ESCHER

The formation of fats by microorganisms. S. (SULZBER) 11A. Selection for quality of oil in soy beans (COLL, *et al.*) 11D. Oxidation of certain fatty acids (RHINE) 11D.

Sulfonating fats, oils and their acids. GOMM, H. T., AKT. GES. Brit. 263,117, Dec. 16, 1925. In effecting sulfonations, the presence of org. acid anhydrides or chlorides as described in Brit. 261,885 (*ibid.* 21, 3476) the proportion of anhydride or chloride is increased so that there is more than 1 mol. of anhydride or chloride for each mol. of oil, *et seq.*, equal parts of castor oil and Ac_2O may be used. A greater proportion of H_2SO_4 is thus combined and products are obtained useful as wetting agents, for cleansing, fat-splitting and other purposes.

Catalyst for hardening oils. CAPTION, F. L. U. S. 1,645,377, Oct. 11, 1927. Ni and Cu formates are used together (about 10-20% as much Cu as Ni).

Powdered soap by spray desiccation. GILLDAY, U. S. 167,499, Sept. 27, 1927. See original pat. 1,621,506 (*ibid.* 21, 1557).

Soap chips. A. F. JOHANSSON, Swed. 62,912, May 10, 1927. Soap, boiled with borax, the mass is cut into chips, then there are added separately Na_2CO_3 , turpentine and NH_4 , and the mixt. is worked to the desired consistency. A suitable compn. is pure soap 52, borax 10, Na_2CO_3 11, turpentine 10 and NH_4 14%, by weight.

Cleaning powder. KOOPERATIVA FORBUNDET, Swed. 62,211, Jan. 1, 1927. Saponifiable fat or oil together with the required amts. of NaOH and water and fine soda powder are blown into a container by means of compressed air in such a way that they are mixed intimately. Instantaneous sapon. takes place with formation of a dry soap powder, which accumulates in the bottom of the container.

Detergent. G. C. BRYSON, Can. 273,774, Sept. 13, 1927. A detergent is composed of 1200 cc. H_2O , 400 g. soap, 15 dr. alk., 14 dr. oleic acid, 6 dr. glycerol, 1 g. NaOH .

Detergent. AKTIEBOLAGET OXYGENOL, Swed. 63,314, July 12, 1927. Soap powder is mixed with insol. porous substances and with a neutral stearate of Ca, Mg or Zn or acid K or Na stearate.

28 - SUGAR, STARCH AND GUMS

The present status of the Louisiana sugar industry. A. H. ROSENFELD. *Int. Sugar J.* 29, 355-61 (1927).—R. discusses the causes for the decrease in production which has fallen from 263,476 tons in 1918 to 42,112 tons in 1926. W. L. OWEN

The composition of juices in the campaign of 1926-7. JIRÍ VONDRÁK. *Z. Zuckerind. czechoslov. Rep.* 51, 393-7 (1927); *Časť Cukrovar.* 45, 227 ff. (1926-7).—The weather in the growing season was unusually rainy, but the only serious difference noticed in the mills was an ally of the juices so high as to make boiling difficult. The av. of 3 samples of diffusion juice showed: Brix 17.07, polarization 15.59, purity 91.3, invert 0.10. Calcd. to 100 polarization, nonsugars 9.5, sulfate ash 2.60, total N 0.431, albumin N 0.078, ammonia N 0.026, amino N 0.112, betaine N 0.108, harmful N 0.257. Thick juice averages were: Brix 61.91, polarization 58.79, purity 95.0, Clerget 7.7 alk., % CaO to phenolphthalein 0.050, color, degrees Stammer, 9.7. Calcd. to 100 polarization, nonsugars 9.5, sulfate ash 2.02, Ca salts as CaO 0.023, color, mg. Fe 12.8, total N 0.286, albumin N 0.002, ammonia N 0.006, amino N 0.040, betaine N 0.105, harmful N 0.258. The thick juice had the lowest N for several years. W. L. BADGER

Filter cloths in the campaigns of 1916-17 and 1920-21. K. ŠANDERA. *Z. Zuckerind. czechoslov. Rep.* 51, 385-92 (1927); *Časť Cukrovar.* 45, 69 ff. (1926-7).—A summary of the results of 2 questionnaires shows the widest divergence in frequency of changing cloths, frequency of washing, and total life. None of the results could be coordinated.

with variations in operation. In 1916-17, 24% of the mills reporting changed cloths oftener than 7 days, 37% changed in 7 to 14 days,*and 39% used the cloths longer than 14 days. In 1920-21 the corresponding figures were 39%, 33% and 28%. Tearing tests on samples of new and used cloths showed that some mills discarded cloths when down to 50-70% of the original strength, while others used them till only 20-25% of the original strength was left. It is recommended that cotton cloths be discarded when they fall to 25% of their original strength, linen at 40%, and jute not less than 50%. Single or double cotton cloths were greatly preferred in most mills; cotton over jute next, and jute alone or linen alone least.

W. L. BADGER

Some properties of cane-wax complex. C. F. BARDORF. *Can. Chem. Met.* 11, 231-4 (1927).—The waxy material naturally occurring in the sugar cane persists throughout the raw-sugar factory and can be traced again throughout the refinery. It is adsorbed to a varying extent by filter cloth, paper pulp, kieselguhr, and especially by bone char. Cane wax was detd. in the rind of the cane and in the different products of the raw-sugar factory, in the case of solid materials by direct extn. with hot acetone and hot alc., and in solns. by first trapping by means of Na_3PO_4 , followed by extn. with the solvents named. Filter-press cake on a Cuban estate contained 21.16% of wax, and molasses may contain 2-3%. The wax complex consists of at least 5 different constituents, 3 extd. by acetone, 1 by alc. and 1 by H_2O , but the most important are an olive-green, soft wax, m. 52° , extd. by acetone, and a brown wax, m. 82° extd. by alc. The quantities of material extd. by acetone and alc. from a no. of raw-sugar-factory products are shown in a table. The green wax can be heated to 460° without decomposition; it boils at $470-80^\circ$. The brown wax is a little less stable, and starts to decompose almost as soon as boiling begins at 450° . The green wax contains 6-7% of an oil which distills off at $280-300^\circ$. The waxes can easily be emulsified in H_2O or sugar soln., by shaking at 40° or over, giving practically uncolored emulsions. But the oil contained in the acetone ext. gives a decidedly brown coloration, under the same conditions. The wax complexes are very resistant to H_2SO_4 and to strong NaOH soln. in the cold. The sapon. nos. of both complexes are very high, varying from 168 to as much as 860, depending on their source. Further studies are promised.

F. W. ZERBAN

Sugar losses in the storage of beets. J. J. DOCHLENKO. *Zapiski* 4, 77-86 (1926-7). *Centr. Zuckerrind.* 35, 301-2 (1927).—Samples of beets were enclosed in nets and stored in silos. The sugar loss was 0.012% per day in 1924 and 0.021 in 1925. In warm weather the beets rotted rapidly, the rotted parts showing no sucrose, much invert, and high acidity. Molds also appeared, and the moldy beets showed less sucrose, more invert, and higher acidity than sound beets. The molds started on injured areas, but when once started, spread rapidly through the silo. One % formalin had no effect. Three % formalin killed the molds, but made the beets woody. Lime milk of 7°Bé . was most effective. On long storage the harmful N increased somewhat in sprouted beets and considerably in moldy beets. This was accompanied by a decrease in total N, a decrease in albumin N, and no marked change in amino or ammonia N.

W. L. BADGER

Experiments on beet silos. SIEGFRIED KUDELKA AND ERNST SCHOLTZ. *Z. Zuckerrind. czechoslov. Rep.* 51, 347-52, 365-8 (1927).—Beets were stored in (A) a silo 3 m. wide at the bottom and 3.3 m. deep, (B) the same but with a ventilation canal under the center, and (C) an unventilated silo 4 m. wide at the bottom and 2.2 m. deep. Sample lots of beets were stored at various points in nets so that samples could be taken, and thermometers were inserted at various points. The test lasted 40 days, and the weather was rather mild. Gates on the ventilation canal under (B) were opened once at night or on cold days. The av. sugar loss per day in % on beets was: (A) 0.0201%; (B) 0.0159%; (C) 0.0156%. By taking losses over shorter periods of fairly constant temp. and plotting against temp., a smooth curve was obtained, ranging from 0.010% loss at 8.9° to 0.030% at 15.1° . The smaller silos are preferable as there is less loss of overheating, but large silos properly ventilated are about as good. The lowering of temp. by proper ventilation more than offsets any loss due to increased vegetation. In both ventilated and unventilated silos the temp. was highest in the upper layers. Beets were also stored in heaps of about 30 kg. in a well-ventilated cellar, and showed a sugar loss of 0.0547% per day over 60 days. Different types of beets in a large silo showed that poorly topped beets did not lose sugar for some days (apparently due to outer ripening) but then sprouted and lost sugar much faster than properly topped beets. Small beets kept better than large ones. Beets of high sugar content (20-21%) lost 0.06-0.07% sugar per day; beets of 16-17% sugar lost 0.03-0.04% per day.

W. L. BADGER

Conserving sugar beets by drying. G. S. BENIN. *Nauchnye Zapiski* (Russian) 5, 49-55(1927); cf. C. A. 21, 3282. • The purification of the diffusion juice from dried sugar beets by the ordinary methods of defecation may be accomplished with a fair degree of success. The color of the purified juice is deeper when the product is derived from dried beets and a special decolorizing operation is necessary. Expts. on drying under reduced pressure showed that the beets loose just as much sugar as when dried in the ordinary way. J. S. JOFFE

Testing sugar beets for inversion and for sugar content of the diffused juice produced from them. N. I. KARAVAEV AND A. PALKIN. *Bull. Univ. Asie centrale* (Tashkent) 10, 125-8(1925). *Chem. Zentr.* 1926, II, 663-4.—Drying of fresh sugar beets reduces the cost of transportation, makes possible the production of concd. ext. and eliminates loss by perishing. There is no inversion of the sucrose by drying at 60-100° or in sunshine until the beets had lost 60-68% by wt., resulting in an increased invert sugar content of only 0.002-0.005%. The diffusion of the sugar from the dried beets was no different from that from fresh beets, but the sugar content of the ext. was much higher for the dried beets (30.4% compared with 15.4%). C. C. DAVIS

Electrometric determination of the "vitality" of vegetable tissues and measurements of the toxicity of certain poisons on the beet. F. NEUWIRTH. *Z. Zuckerind. czechoslov. Rep.* 51, 249-57(1927). *Listy Cukrovar.* 45, 61ff.(1926-7).—A Zn and a Ag electrode were inserted into beet tissue, and connected through a high resistance to a galvanometer. Resistance of the tissue was expressed as millivolts read. Sound live beets gave 50-65 millivolts, dead tissue up to 180. SO₂ and NH₃ killed the beet in less than 1 hr., H₂S and CHCl₃ after 10 hrs. Chloropicrin, Et₂O, CO₂, solvent naphtha and p-C₆H₄Cl₂ had little or no effect after 10 hrs. W. L. BADGER

Amino acids and related compounds in sugar products. J. A. AMBLER. *Intern. Sugar J.* 29, 382-5, 437-41(1927).—Amino acids in cane and beet juices are responsible for many abnormalities in the working of the juice at certain times and for the occasional abnormal behavior of the molasses, such as in the foaming of massecuites, or the formation of gas in molasses which causes "swells" in cans. The ordinary tests for amino acids are not applicable to sugar products because of the very small quantities that are present. A simple modification of Riffart's method (C. A. 16, 4228) is satisfactory for sugar work. Prep. a standard soln. of aspartic acid contg. 0.4749 g. of the acid in 500 cc., or 100 mg. N per l. From this soln. make other standards contg. from 5 to 25 mg. N per l. Prep. two M/15 solns., of KH₂PO₄ and Na₂HPO₄·2H₂O, resp., and mix in the ratio of 2 to 3 immediately before using; the p_H of this buffer soln. is 6.796. To the tubes contg. 1 cc. each of the standard solns. add 1 cc. of a 50 Bx. soln. of granulated sugar, and to the unknown soln. 1 cc. of distd. H₂O, then to all of the tubes 2 cc. of the mixed buffer soln. and 1 cc. of 1% ninhydrin soln. Place the tubes in a wire basket and heat for 0.5 hr. in a boiling water bath. Cool for 0.5 hr., transfer to measuring cylinders, dil. to 100 cc. with cold H₂O, and compare colorimetrically. Previous difficulties with the method were due to variations in the p_H. The method was tested on refinery products, with very satisfactory results. Bone char removes about 70-80% of the amino acids from concd. sirups, but their concn. increases about 200 to 300% in the sweet waters, and still further in the wash-water to the sewer. W. L. O.

Analysis of sugars by comparative measurements of fluorescence. HARALD LUNDÉN. *Centr. Zuckerind.* 35, 219-20(1927).—Crystals of a purity over 99.95 cannot be exactly evaluated by ordinary methods. In the ultra-violet such material shows marked fluorescence, and the fluorescence is roughly parallel to the amt. of impurities. Different sized grains have different fluorescence. Dyes which affect the color of a sugar in visible light do not affect its appearance in ultra-violet light. Cane and beet can be easily distinguished. The examn. is made in solns. of 40-60° Brix, and numerical values are obtained by dilg. till equal to a standard. Two fluorescence bands are found. The yellow one increases with increasing alk. and is caused by substances formed on heating the juice. These substances are less absorbed by the crystals on crystg. a soln., and are more easily removed by decolorizing carbons. The blue fluorescence decreases with increasing alk. between p_H 5 and 11, and is especially strong in colonial sugars. The substances causing it are removed by kieselguhr, and are strongly absorbed by growing crystals. Good beet products show yellow fluorescence, only the best refined beet sugar showing blue fluorescence. The blue fluorescence corresponds to L.'s amethyst coloring matter (cf. Šandera, C. A. 21, 3761). W. L. BADGER

Practical application of p_H determinations at the sugar factory Gondang Winan- (Java). H. A. MACGILLAVRY AND J. DEINEMA. *Arch. Suikerind.* 35, 872-7(1927).—Titrations and the use of litmus paper for thin juice tests have been abandoned. Bromothymol blue is now being used instead, in connection with the color

charts of the expt. station. In 1st carbonation the settling test is employed, together with the use of Dupont paper. The 2nd carbonation is still controlled by titration, but after a further study it will probably be possible to substitute p_H detns. A series of expts. has shown that it is best to sulfur the thin juice to p_H 7.1, bromothymol blue and bromocresol purple being used. Under these conditions it is generally unnecessary to sulfur the thick juice. The p_H of the thick juice is usually about 0.1 higher than that of the thin juice. The new control has made it possible to reduce the quantity of S used; on account of the neutral reaction of the juices there is less destruction of glucose, and therefore less frothing of massecuites; the viscosity of the products, especially of the low-grade massecuites, has also been reduced. F. W. ZERBAN

Polarization apparatus with photoelectric indication. WINIFRED E. DICKES. *Z. Zuckerind. u. o. choslov. Rep.* 51, 379-80(1927).—The app. of Staněk and Šandera (*C. A.* 21, 3492) if properly arranged should have a sensitivity of 0.02° Ventzke instead of 1° as claimed. W. L. BADGER

Comparison of the results of molasses analyses, obtained in the factory laboratories and at the experiment station, for the years 1925-26 (Java). P. HONIG. *Arch. Suikerind.* 35, 859-72(1927).—The analyses were made in both cases by the official methods of the expt. station (*C. A.* 21, 191). The comparisons are shown in the form of tables and graphs. Checks between d. detns. were not very good. Many factories still use the spindle instead of the pycnometer; for this reason their results are generally high, first because the fine ppt. formed upon diln. of the molasses settles to the bottom, causing a higher d. around the bulb of the spindle, and second because the molasses soln. has a lower surface tension than a sucrose soln. of the same concn. Polarization as well as sucrose figures checked very well in a large no. of cases; with a little more care better agreement could easily be attained in the others. Results of reducing sugar detns. show considerable differences, those obtained in the factories generally being low. It appears that the method is not well suited for the factory lab. A better supervision of the personnel by a trained chemist is necessary. F. W. ZERBAN

Deterioration of cane mill juices and its prevention by antiseptic measures. J. H. HALDANE. *Intern. Sugar J.* 29, 367-70(1927).—It is now generally recognized that the losses in sucrose during milling, due directly and indirectly to the development of microorganisms, are considerable. This is apparent from comparisons of differences in purity between first mill and mixed juices in factories where precautions are taken to prevent the growth of microorganisms, and in those where they are not. Preliminary investigations suggested the possibility of using a cheap antiseptic like "E. C." (*Intern. Sugar J.* 28, 85(1926); cf. *C. A.* 20, 1531) to great advantage. Expts. were made comparing the efficiency of E. C. and formalin, on crusher, mixed and last-mill juice, resp. The results showed that the 2 substances are approx. equally efficient. Although the inverting activities of microorganisms can be restrained by the use of these antiseptics, some loss of sucrose will still occur, dependent upon acidity, concn., and temp. E. C. is recommended as a preventive of the deterioration of cane juice during milling. After a wash down, and periodically during milling, the mill beds, cheeks and gutters, and intermediate carriers should be sprayed with E. C. contg. 2% Cl. A continuous trickle of a 1.500 soln. of the antiseptic should be allowed to flow into all juice gutters to prevent the deterioration of the juices during their passage through the mill. The concn. of the E. C. should be increased to 1:200 during the latter stages. W. L. OWEN

The defecation of diffusion juice with dolomitic lime, and with mud obtained by defecating intermediate juice with dolomitic lime. WENZEL KOHN. *Z. Zuckerind. u. o. choslov. Rep.* 50, 209-15, 217-21(1926); *Listy Cukrovar.* 42, 297ff.(1923-4).—If dolomitic lime is added to diffusion juice in amts. from 0.35 to 0.40% of the juice vol., after warming the ppt. settles rapidly and satisfactorily, but amts. over 0.4% do not settle at all. Overcarbonating improved the settling only in a few cases. Adding to diffusion juice, mud from 2nd juice which had been carbonated with dolomitic lime, gave unsatisfactory clarification and darker juices, though the purity was not lowered. Adding 2nd mud after the 1st carbonation but before the 1st filtration had no harmful effect. A juice limed and carbonated twice with dolomitic lime showed poorer color and purity than when the same amt. of dolomitic lime was used but the mud was not filtered off between carbonations. W. L. BADGER

Continuous automatic measuring outfit for the diffusion juice. P. R. CHECHEL. *Nauchn. Zapiski* (Russian) 5, 57-9(1927).—A description of an app. and a drawing with explanations. J. S. JOFFE

Effect of the color of juices and green sirups on the color of sugar crystals. WALTER KORN. *Centr. Zuckerind.* 35, 496-7(1927).—Five different pans were followed closely

and full data are given. Small variations in the color of the sirup are of little effect on the color of the crystal, but if 35% or more of green sirup is drawn in, there is a decided increase in the color of the sugar produced.

W. L. BADGER

Decolorizing carbons. SIEGFRIED KÜHN. *Z. Zuckerind. cechoslov. Rep.* **51**, 271-2(1927); cf. *C. A.* **21**, 832.—A question often raised is the necessity for pre-filtration in using carbons by the "layer" method. Total suspended substance in the liquor from the dissolving pans was 0.08-0.15 g. (av. 0.11) per kg. affined sugar. Of this about $\frac{1}{3}$ was org. and $\frac{2}{3}$ inorg. Similar detns. on liquors ready for pre-filtration gave about 0.4 g. per kg. affined sugar, mainly inorg.

W. L. BADGER

Further experiments with decolorizing carbons. ALBERT SCHÖNE. *Deut. Zuckerind.* **52**, 323-4(1927); cf. *C. A.* **20**, 2917; **21**, 832.—A 60° Brix sirup (alky. 0.02%) made from refined sugar was heated 15 min. at 85-90° with varying amts. of Carboraffin and Norit. There was a decrease of alky. and an increase in invert with both, the effect being larger with larger amts. of either, and larger with C than with N. In a 2nd series where sirups of different alkys. were used and color was also detd., the results were similar. C had the stronger decolorizing power, and caused a systematic increase in inversion as the amt. used was increased. The inversion caused by N was not only smaller but was erratic.

W. L. BADGER

Technical experiments with various activated carbons in the campaign of 1925-6. A. LINSBAUER AND JAR. FIŠER. *Z. Zuckerind. cechoslov. Rep.* **51**, 353 65, 369-79(1927); *Listy Kukurar.* **45**, 101ff.(1926-7).—Four large-scale expts. were carried out using (a) Carboraffin, (b) Polycarbon, (c) Supranorit 2x, (d) Supranorit 3x, (e) Superiornorit, (f) Standard Norit, and (g) Anticromos. The method of "filtration in layers" was adopted, using both filter presses and mech. filters. Two kg. of the carbon was used per sq. m., the temp. was held at 80°, and the rate of filtration at 1 hectoliter per sq. m. per hr. (2.46 gal. per sq. ft.). With mech. filters the % color removal was (a) 40, (b) 39, (c) 39, (d) 44, (e) 35. Thick juice in the same filters gave: (a) 38, (b) 23.5, (c) 37, (d) 29. In filter presses the % color removed from 1st refinery sirups was: (a) 32, (b) 29, (f) 29, (g) 32.5; for 2nd sirups: (a) 14.7, (b) 4.6, (f) 16.5, (g) 8.3; for thick juice from partly altered beets: (a) 16.4, (d) 15.4. Filter presses are not recommended for the "layer" method. All the carbons were in general satisfactory, in spite of differences in price and in the results of lab. evaluating tests. Carboraffin 1925 is of remarkably better quality than Carboraffin 1924. Polycarbon and Anticromos are well suited to 1st refinery sirups but not for beet mill products. For sirups the cheapest sorts of carbon, liberally used, are recommended. Careful and continuous control of the filter station is necessary.

W. L. BADGER

The regeneration of active carbons. ADOLF RIERETH. *Centr. Zuckerind.* **35**, 332-3(1927).—Samples of active C were treated with molasses soln. until the decolorizing power was completely destroyed. They were then heated in a vacuum to 900° and then re-tested. The % color removed from a 5% molasses soln. by fresh carbon (a), once regenerated (b), twice (c), and 3 times regenerated (d), was: Eponite I, (a) 99, (b) 98.5, (c) 88.5, (d) 66; Eponite II, (a) 96, (b) 97, (c) 83.5, (d) 42.5; Carboraffin, (a) 97, (b) 40, (c) 12, (d) 2.

W. L. BADGER

Carboraffin and Norit. MAKULIK. *Deut. Zuckerind.* **52**, 133-4(1927).—The entire refinery was operated 9 days on Supra-Norit 2X, and 7 days on carboraffin. Brix, polarization purity and color, were approx. the same in the sirups used for the 2 tests. With Norit the color was lowered 14.9% (from 58.3 to 49.6° Stammer); with carboraffin the removal was 25.0% (from 54.0° to 40.5°). KATHOL. *Ibid* 191, 328 MAKULIK *Ibid* 267, 404 ZERT. *Ibid* 378.—Polemie.

W. L. BADGER

Washing bone-black filters. FR. NOSEK. *Z. Zuckerind. cechoslov. Rep.* **51**, 399-400(1927).—The filters were washed with H₂O to 97 purity, then steamed for 1.5 hrs., and again washed. The results were a decrease of sweet water by 50-60%, the possibility of discarding the last impure wash, a saving in time of 4-5 hrs., and a sterilization of the filters.

W. L. BADGER

The influence of small additions of common salt and albumin on the taste of commercial sugars. HARALD LUNDÉN. *Centr. Zuckerind.* **35**, 419-20(1927).—Addns. of 0.002% NaCl to 3% sugar solns. had practically no effect. 0.01% NaCl increased the sweetness of refined beet sugars, and had little effect on cane sugars. There was little or no salty taste. 0.02% NaCl gave a salty taste to refined sugars, but not to an unrefined beet sugar of 99.90 purity. The lower the purity, the larger the amt. of NaCl that could be added without a salty taste. Egg albumin, added in amts. of 0.005% to 3% sugar solns., decreased the sweetness, more strongly in sugars of higher purity.

W. L. BADGER

The chemistry of starch. W. EKHARD. *Z. Spiritusind.* **50**, 172-3(1927).—A

discussion is given of diastatic and proteolytic enzymes and of the newer views on the structure, formation and chemistry of starch. C. N. FREY

Polarimetric determinations of starch. C. v. SCHEELE AND G. SVENSSON. *Svensk Kem. Tid.* 39, 233-44(1927).—Fryers and Lintner-Schwarz methods for barley starch agree very well with one another and starch-by-difference if correction is made for sol. rotating substances and if $(\alpha)_D$ is taken as 182.8° for the former and 203.2° for the latter method. The errors are 0.2 and 0.7° , resp. A. R. ROSE

The purification of corn starch sirup by means of Norit. W. BARTLING. *Z. Spiritusind.* 50, 122, 130, 137-8(1927).—Translation by Stirnus. A detailed description of the methods of mfg. corn starch sirup. The use of Norit during filtration is described. C. N. FREY

The treatment of beet flume and washer waters (HIRSCHFELDER) 14. Soil acidity and the growing of sugar beets (OGG) 15. Continuous centrifugals (PANKRATH) 1.

Extracting sugar from bagasse. HENRY ISTEILL. U. S. 1,645,242, Oct. 11. Bagasse is agitated and mixed with extracting fluid such as H_2O and simultaneously sprayed with the fluid, and the sugar soln. obtained is sepd. An app. is described.

29— LEATHER AND GLUE

ALLEN ROGERS

Prof. H. R. Procter. LEOPOLD POLLAK. *Gerber* 53, 133-4(1927).—An obituary.

H. B. MERRILL

Mineral oils in the leather industry. FRIEDR. BACHMANN. *Ledertech. Rundschau* 9, 172-3(1927); cf. C. A. 21, 2396 --Polemical. I. D. C.

Pigment colors and their use in the leather industry. WILHELM VOGT. *Ledertech. Rundschau* 19, 148-50, 153-8, 165-8, 180-2(1927).—A general description of the pigments, binders, solvents, diluents, etc., used in leather colors. I. D. C.

The influence of sodium sulfide liquors in the manufacture of sole leather. VIRRO CASABURI. *Ledertech. Rundschau* 19, 105-11, 117-24, 129-35, 141-6(1927).—The soaking of dry hides can be eliminated if Na_2S is used instead of lime. The same quantity of OH^- is taken up by hide regardless of the concn. of Na_2S . The addn. of NH_4Cl to the Na_2S liquor is not needed for sole leather but is preferable for other leathers. $CaCl_2$ is a favorable action. The max. yield of leather is obtained after a $1.5^\circ B^e$. Na_2S or concn. $NaCl$. The high yield is obtained because there is no loss of hide surface in the soaks, the hide is completely hydrated and is only surface-neutralized. The swelling should be maintained up to the time of combination with tannin and a thin acid layer (pH 5) should precede the tannin soln. through the hide. Numerous photomicrographs are given. I. D. C.

Importance of hydrogen-ion concentration in preliminary stages of leather manufacture. H. T. S. BRITTON. *Ind. Chemist* 3, 362-6(1927).—A review. H. B. M.

The hygroscopic properties of leather according to the investigation of Wilson, Webb and Kern. M. HIRSCH. *Collegium* 1927, 403-7.—A review. I. D. C.

Sources of error and other difficulties in the determination of free acid in leather. LAUFFMANN. *Ledertech. Rundschau* 19, 124-6(1927).—Leather contg. a known quantity of free acid cannot be prepd. Errors in detg. free acid are caused by hydrolysis or, or incomplete leaching with H_2O , reaction of strong acids with salts of weak acids, loss of SO_4 by heavy-metal sulfates during ashing, S in the hides, etc. The acid is no longer be present in deteriorated leather but Moeller has found that such leather contains H_2O -sol. N. I. D. C.

Chemistry of animal skin. Hydrolysis in acid solution. GEORGES GRASSER AND TAGUCHI. *Cuir tech.* 16, 426-8(1927).—Samples of unhaird skin were boiled with portions of various acids at various concns., until the soln. no longer gave a positive test for gelatin when tested with tannin soln. In general, the rate of hydrolysis is directly proportional to H-ion concn. H. B. MERRILL

Leather dyeing. J. W. LAMB. *Ind. Chemist* 3, 389-90(1927).—A brief description. H. B. MERRILL

Chrome tanning and other mineral tanning processes. H. T. S. BRITTON. *Ind. Chemist* 3, 411-4(1927).—A discussion, chiefly of recent work dealing with effect of H-ion concn. H. B. MERRILL

Tanning and complete tanning. J. JOVANOVIĆ. *Collegium* 1927, 226-34.—

Collagen fibers show double refraction which is changed by heat, acids, alkalies or tannin (cf. Kuntzel, *C. A.* **20**, 1337). The isolated band-like fibers (probably elastin) are not changed. The polarization microscope can be used to follow the rate of tanning to test for green streaks in leather or burnt streaks in shoe soles. Very thin sections are not necessary.

The relation between tanning agents and vegetable dyes. KARL FREUDENBERG. *Festschrift 100-jähr. Besteh. Tech. Hochschule Karlsruhe* **1925**, 476-81; *Chem. Zentr.* **1926**, II, 2605.—Phloroglucinol tanning substances of high mol. wt. decomp. on energetic treatment into phloroglucinol, pyrocatechol and lower fatty acids. The same components should yield the hitherto unknown parent substances of phloroglucinol tanning substances. Moreover they should have the capacity for condensing irreversibly to tanning substances of high mol. wt. Since catechols, which occur in numerous plants, decomp. to the same products as do phloroglucinol tanning substances, and also readily condense, it is assumed that they are the parent substances of phloroglucinol tanning substances. The hypothesis of the correlation between the catechols and phloroglucinol tanning substances suggests in turn that there is a close relation between these assoc. groups and the vegetable dyes of the anthoxanthidin and anthocyanidin classes, since likewise in these substances phloroglucinol is combined with pyrocatechol. After recent researches, the relation between the catechols and the catechol tanning substances is regarded as established. A comparison of the formulas of the parent substances (hydrochalcone, catechol, catechol tanning substances, chalcone, anthocyanidin, flavone and flavonal) shows that the difference between these classes of substances rests on the stages of oxidation of the 3 C atoms lying among the C_6H_6 nuclei. If the occurrence in nature of the individual substances is investigated, it is found that members of the same classes often occur in the same plants. Where different stages of oxidation exist in a plant, these natural substances agree in the arrangement of their phenol hydroxyl groups. Thus from quercitol the series passes to cyanidin and thence to catechol. Quercitol and catechol are found together, as also are fisetin and the quebracho tanning substance, whose parent substance, quebrachocatechol, is still unknown. It is considered probable that an analogy exists between the still undiscovered fisetinidin and the likewise unknown catechol of the quebracho tanning substance. Since cyanidin can be hydrogenated to epicatechol, the hypothesis is considered of sufficient importance to justify expts. on the analogous conversion of fisetinidin to synthetically prep'd. quebrachocatechol and condensation to the corresponding amorphous tanning substance.

C. C. DAVIS

Determining the kind of tannin in leather by Gerngross' fluorescence method. C. F. ROSEK. *Ledertech. Rundschau* **19**, 137-8(1927).—Sulfite cellulose was detected in a sample of leather.

I. D. C.

Water in the tannery. M. AUERBACH. *Ledertech. Rundschau* **19**, 184-5(1927).

I. D. C.

A study by means of x-ray spectrographs of the tanning of skins and sinews. J. R. KATZ AND O. GERNGROSS. *Kolloid-Z.* **40**, 332-3(1926).—Examn. with monochromatic x-rays of a disk of leather cut parallel to the surface of the skin gives a diagram having a bright, "amorphous" inner ring and a very narrow outer ring comparable in sharpness with crystal interference patterns. Different leathers give the same diagram except for differences in the intensity of the 2 circles. Oak-bark-tanned leather has a weak outer circle and HCHO-tanned leather a very bright one. When sinews are exam'd., in which the collagen fibrils lie parallel to each other, the circles are resolved into more sharply defined segments. Tanning of such sinews for a long time in pine or quebracho ext. or in HCHO fails to change the x-ray diagram, but sinew tanned in oak ext. gives a diagram in which the outer crescents are less bright. The diagram for oak-tanned sinew resembles that for gelatin. The failure of HCHO tanning to alter the diagram is surprising since the HCHO presumably reacts with the basic groups of the protein. Perhaps the chem. reaction is limited to the surface of the micelles and the major part of the structure of the micelles remains unaltered. It is known that x-ray patterns are not altered by adsorption of other materials.

F. L. BROWNE

X-ray examination of the tanning of membranes and tendons. R. O. HERZOG. *Kolloid-Z.* **41**, 277(1927).—Polemical (cf. Katz and Gerngross, preceding abstr.).

E. J. C.

A titration method for the evaluation of enzymic bates. JOSEF SCHNEIDER AND ANTONIN VLCEK. *Collegium* **1927**, 342-9; cf. *C. A.* **21**, 2396.—Heat 30 cc. of casein soln. (90 g. per l., pH 8.4), 20 cc. of H_2O and 50 cc. of enzyme ext. in a thermostat at 40° for one hr. Then add 100 cc. Na_2SO_4 (100 g. salt and 50 cc. $NHCl$ per l.) to ppt. unchanged casein, filter, add 45 cc. of neutral 36% $HCHO$ and titrate with 0.1 N

NaOH and cresolphthalein. Oropion-Standard is used as the standard reference enzyme. Blanks without casein are run at the same time and corrections are made. The bate ext. is prepd. by leaching 2.5 g. of bate for 30 min. at 18° with 500 cc. of water contg. sufficient NH_4 salts to give 2.5 g. $(\text{NH}_4)_2\text{SO}_4$ and 1.0 g. NH_4Cl in the final ext. The NH_4 , SO_4 and Cl in the bate must be detd. in another ext. I. D. C.

The definition of the casein test as a method for evaluation of enzymic bates. J. SCHNEIDER AND A. VLCEK. *Gerber* 53, 134-5(1927); cf. *C. A.* 21, 1895.—Polematical.

H. B. MERRILL
The tannin of the native oak and the chestnut. ADOLF KURMEIER. *Collegium* 1927, 273-88.—Freshly extd. tannin from oak leaves and shoots was pptd. as the Pb salt, freed from Pb with H_2SO_4 , treated in dil. soln. with pyridine to remove condensation products, pptd. from this soln. with $\text{Pb}(\text{AcO})_2$, freed with H_2SO_4 and pptd. with quinine. Yield 60% of the raw tannin. The pure tannin was optically active, $[\alpha]_D = -30^\circ$, and contained no sugar before or after H_2SO_4 hydrolysis. Me compds. were prepd. Chestnut tannin seemed identical with oak except that the mol. wt. of the Me deriv. (660) was 20 units lower. Ellagic acid was removed from the tannin with NaOH, yield 16 17%, dil. H_2SO_4 , 12% or tannase 8-10%. Ellagic acid was detd. as pentaacetate, m. 222°, or pentamethyl deriv., m. 164°, of hexahydroxydiphenylcarboxylic acid. The latter is formed on boiling ellagic acid for 20 min. with 5% NaOH in the absence of air; boiling 45 min. gives hexahydroxydiphenyl. I. D. C.

Russian tannin plants. CARL PETERS. *Ledertech. Rundschau* 19, 146-8(1927).—A brief description of common bark and badan, taran (*Polygonum alpinum*), kermek (*Statice Latifolia*) and sumac. I. D. C.

Direct measurement of plumping power of tan liquors. R. E. PORTER, et al. *J. Am. Leather Chem. Assoc.* 22, 521-5(1927); cf. *C. A.* 20, 3359.—The plumping power of a soln. of chestnut ext., to which were added varying amounts of lactic acid and NaCl, was detd. by 4 diff. analysts by the hide-powder method. Satisfactory agreement between individual analysts was obtained. H. B. MERRILL

The influence of the method of reduction on the precipitation number. I. G. GRASSER AND S. SAWAYAMA. *J. Coll. Agr. Hokkaido Imp. Univ.* 20, Pt 2, 73-8(1927).—Different chrome tanning solns. of the same basicity have different pptn. nos. and consequently different behaviors in tanning. The org. reduction medium employed has a powerful influence on these characteristics. The expts. were carried out as follows: 50 cc. of 0.2 M $\text{K}_2\text{Cr}_2\text{O}_7$ soln. and 41.5 cc. of 1 M H_2SO_4 soln. were mixed and reduced with the vol. of each reducing agent indicated by the first number following its name and dild. to 250 cc. Ten cc. of this 250 cc. required the number of cc. of 0.1 N NaOH represented by the second number following each named substance to cause a cloudiness. CH_3OH 15, 12.5; $\text{CH}_3\text{CH}(\text{OH})\text{COOH}$, 3, 27.1; $\text{C}_2\text{H}_5\text{O}_4$, 8.0, ∞ ; NH_2OHCl , 1.6, 21.5; CH_2O (neutral) 15, 17.8; $\text{C}_3\text{H}_7(\text{OH})_3$ (neutral), 5, 15.7; glucose, 1.6, 13.9; milk sugar, 5.5, 13.9; sol. starch, 1.9, 31.4; dextrin, 1.6, 15.4; cellulose ext. (30° Bc.), 3.5, 17.4; $\text{C}_6\text{H}_5\text{NH}_2\text{Cl}$, 0.4, 0; H_2SO_3 , -35.3; Na_2SO_3 , 5.4, 4.7; $\text{Na}_2\text{S}_2\text{O}_3$, 6.2, 7.1; FeSO_4 , 14.0, 50.1 F. E. BROWN

Gambier (*Gambier uncaria*). Its extraction and evaluation. B. J. EATON AND R. O. BISHOP. *J. Intern. Soc. Leather Trades Chem.* 10, 395-400(1926).—See *C. A.* 20, 2260. H. B. MERRILL

Use of hide powder from skins of exotic sheep in tannin determination. LOUIS JURY. *Halle aux cuirs* 1927, 236-42, 260-75.—Hide powder, prepd. from dried, imported sheep skins by substantially the same method employed for standard hide powder, gives practically the same analytical results as the latter on quebracho and chestnut exts., and is considerably cheaper. H. B. MERRILL

Introductory remarks to and discussion of chemistry, bacteriology and histology of tanning. G. D. McLAUGHLIN, et al. *J. Am. Leather Chem. Assoc.* 22, 536-40(1927).—Discussion of 3 papers by the author and co-workers (*C. A.* 21, 3139). H. B. M.

Leather cements. WILLY HACKER. *Kunststoffe* 17, 202-3(1927).—The prepn. of leather cement for shoes and cement for glueing of leather straps is described. A no. of recipes are given. D. THUESSEN

The thermodynamics of temperature changes in collagen (WÖHLISCH, DE ROCHE-MONT) 11A. Formulas for 1927 fall shades on chrome-tanned side leather (ANON.) 25. Examination of halophilic microorganisms (CLAYTON, GIBBS) 11C. Determining pH values (WOLF) 7. Analysis of Na_2S (ATKIN, HUGONIN) 7.

Hide-disinfecting process. G. WESENBERG. *Can.* 274,780, Oct. 18, 1927. A

process for disinfecting hides, skins, etc., consists in treating these products with a soln. of a Na salt of *N*-chloro-*p*-toluenesulfonamide.

Treating fur hides. N. E. ANDERSSON. *Swed.* 63,275, July 5, 1927. The fleshy side of the hides in dry state preferably after grinding and dyeing is coated with a body-color consisting in a mineral pigment mixed with a binding substance. After drying the surface is spread with fat for impregnating purposes and is finally coated with a varnish.

30—RUBBER AND ALLIED SUBSTANCES

C. C. DAVIS

Rubber chemistry. W. C. GEER. *Ind. Eng. Chem.* 19, 1095-8(1927).—A survey of developments in the rubber industry for which chemistry and chem. engineering are responsible, and without which automotive transportation on its present scale would have been impossible. Special attention is given to the production and improvement of reclaimed rubber and the continual improvements in automobile tires.

C. C. DAVIS

Rubber and its future. J. DUGUÉ. *Rev. gén. caoutchouc* 1927, No. 33, 23-6; No. 34, 19-22; cf. *C. A.* 21, 2815.—Chem. and technological developments of great historical significance are described.

C. C. DAVIS

Studies of rubber and its industry. J. CH. BONGRAND. *Rev. gén. caoutchouc* 1927, No. 33, 15-6, No. 34, 17-8, cf. *C. A.* 20, 839.—Special attention is paid to the part played by chemistry in new development.

C. C. DAVIS

Rubber and rubber mixtures considered from the standpoint of energetics. LOTHAR HOCK. *Kautschuk* 1927, 207-14; *Gummi-Ztg.* 41, 2126-7(1927).—The investigation was begun by the detn. of the *Joule effect in raw rubber*. The measurement of the heat tone during stretching and recovery with thermoclements was impracticable and resort was had to indirect detns. Unstretched rubber and rubber stretched to a predetd. elongation were swelled in a solvent to the same ultimate condition, so that the difference between the observed *heats of swelling* corresponded to the difference in energy between the 2 conditions of the rubber. The results of the measurements showed that the *latent heat of extension* is a linear function of the elongation, which conforms to x-ray studies. Below an elongation of 80%, the heating effect disappears. A comparison of the *heat tones* with the work performed, shows that the latter represents only an insignificant fraction of the latent heat, *i. e.*, the *Joule heat* is by no means an equiv. of a friction process. In connection with the exptl. detn. of the heat of extension, the problem of active fillers was studied from a thermodynamic standpoint. The mutual action between rubber and fillers would suggest that the heat tone of the mixts. does not correspond to the sum of the heat tones shown by rubber and by filler when swollen in a solvent. The difference is a function of the difference in energy of the rubber-filler system before mixing and the same system after being mixed. The difference in heat production may, therefore, be defined as the heat of adhesion. The first investigation showed that 1 g. of "Micronex" C black evolved 3.4 cal. of heat of adhesion within the mixt. and 1 g. of "Thermatomix" black only 1.3 cal. It might reasonably be assumed that the activities of the blacks bear the same relation to one another. Ap. *Std.* calen. shows that the *heats of adhesion* are proportional to the work required to break the rubber mixts. The *reinforcing effect of a filler* can be derived from the nature and the magnitude of the boundary surface of the filler and rubber. There is no relation between the total surface-energy, as measured calorimetrically, and the mech. work expended in breaking the rubber mixts., but only between the free energy and the work. The systems rubber-Dixie clay gas black and rubber-ZnO were investigated in particular detail. From detns. of the heat tone of mixts. of various concns. it was shown that the heats of adhesion decrease with increase in the concn. of the filler. From the ratios of the heats of adhesion at various concns. the utilization of the available surface energy of the particular filler could be estd. and a *measure of the distribution of the filler obtained*. Values of the surface energy measured calorimetrically when compared with the same values detd. from the stress-strain curves showed that the work required to rupture the rubber increased more rapidly with growing concn. of filler than did the total surface energy, in every case because of increasing internal friction. A general discussion follows the paper.

C. C. DAVIS

The energetics of rubber. Thermodynamics applied to the filler problem. LOTHAR HOCK. *India Rubber J.* 74, 419-21, 453-6(1927).—See preceding abstr.

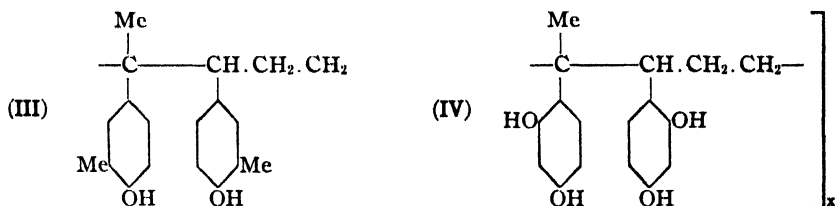
C. C. DAVIS

New derivatives of rubber. G. BRUNI AND E. GEIGER. *Atti accad. Lincei* [6], 5,

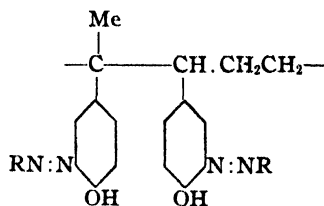
823-8(1927).—During the classic researches of Angeli on the action of PhNO on unsatd. compds., it was noticed that PhNO vapor reacts with rubber (cf. Angeli, Alessandri and Pegna, *C. A.* 4, 2457), and later Alessandri prepd. from the same reagents an unidentified deriv. of rubber (cf. *C. A.* 9, 2240). Because these researches were left uncompleted and because of the potential value of PhNO derivs. for prepg. other derivs. of rubber, a comprehensive study was begun by B. and G. When C_4H_6 solns. of PhNO and rubber (3 mols. PhNO per C_4H_6) are heated 15 min. on the water bath, the soln. becomes green, then yellowish and finally red-brown, and on cooling and pouring into petr. ether, there forms a flocculent ppt. of the compn. $C_{11}H_{17}ON$. It is yellow, decomp. at 135-40°, and x-ray examn. shows no evidence of a cryst. structure. By evapn. of the petr. ether, a large quantity of PhN N(O)Ph is recovered, showing that the reaction proceeds as found by Angeli with other compds.: $[-CH_2.CMe.CH.CH_2-] + 2PhNO \rightarrow [-CH.CMe.C(N(O)Ph).CH-] + PhNH_2$ and $PhNH_2 + PhNO \rightarrow PhN.N(O)Ph + H_2O$. The product is, therefore, a nitrone, *isorubber nitrosobenzene*, and may have the alternative formula $[-CH_2.C(CH_2).C(N(O)Ph).CH_2-]$. The yield is 94-98%, so that its formation constitutes a *method for the direct detn. of raw rubber* which is preferable to those so far proposed. It absorbs Br to form a *dibromide* $[-CHBr.CMe.Br.C(N(O)Ph).CH-]$. The nitrone is also obtained by mixing pyridine solns. of PhNO and latex, which is the first time that a deriv. of rubber has been obtained directly from latex. In a similar manner from *o*-, *m*- and *p*- MeC_6H_4NO and *o*- $MeOC_6H_4NO$ were prepd. the corresponding nitrones: *isorubber o-nitrosotoluene*, *isorubber m-nitrosotoluene*, *isorubber p-nitrosotoluene* and *isorubber o-nitrosocumale*. Unlike *o*- $MeOC_6H_4NO$, nitrosophenols do not react, since they behave as quinone oximes. Rubber and *o*- ONC_6H_4CO-Et (3 mols. per C_4H_6) form *isorubber allyl o-nitrosobenzoate*, which treated with $EtONa$ and acidified with HCl, ppts. the corresponding acid, *isorubber o-nitrosobenzoic acid*, decomp. about 100°, insol. in water but forms true solns. in aq. alkalis. Such nitroso bases as *p*- ONC_6H_4NMe , *p*- ONC_6H_4NMe and $HN(C_6H_4NO)_2$ also react readily with rubber, the products of which are to be described. There may be some relation between the ready formation of these nitroso derivs. and the *accelerating power of nitroso compds.* Gutta-percha behaves like rubber, and *isogutta-percha nitrosobenzene* and its *dibromide deriv.* were prepd. Isorubber nitrosobenzene and $PhHNH_2$ react thus: $[-CH.CMe.C(N(O)Ph).CH_2-] + PhHNH_2 \rightarrow [-CH.CMe.C(NHPh).CH_2-] + PhNH_2$, forming the *phenylhydrazone*, decomp. at 140°. It is the phenylhydrazone of a ketone contg. the carbonyl in the chain of the rubber mol and the name *caudichone* (*caucichone*) is proposed. This compd. opens the way for the prepn. of the corresponding free ketones and from the latter to other unknown derivs., such as ammorrubber. C. C. DAVIS

Rubber and gutta-percha. 1. The condensation of rubber dibromide and of gutta-percha dibromide with phenols and with phenolic ethers. ERNST GEIGER. *Helv. chim. acta* 10, 530-8(1927).—The object of the expts. was to prove whether the Fiedel-Crafts reaction is applicable in general to bromides of high-mol. substances (cf. *Ber.* 33, 791(1900); Fisher, Gray and McCollm, *C. A.* 20, 1987). Rubber dibromide (25 g.), $FeCl_3$ (5 g.) and $PhOH$ (40 g.) heated 2 hrs. at 90-120° until clear, dild. with $EtOH$, filtered, poured slowly into warm dil. HCl, the ppt. purified by soln. in 3% alkali, repptn. by dil. HCl, resoln. in Me_2CO and final pptn. by dil. HCl, yields about 22 g. of bis(*p*-hydroxyphenyl)hydrorubber (II), the method of prepn. being simpler than that of Weber and of Fisher, Gray and McCollm (*loc. cit.*). Röntgenographic examn. indicated that II is amorphous. II (1 g.) in 20% KOH (50 cc.) shaken at 50° with $BaCl_2$ (2 g.), filtered, the residue dissolved in Me_2CO , repptd. by pouring into dil. KOH, yields about 1.5 g. of the *dibenzoate deriv.* of II, brown, m. 195-200°. I (2 g.), $FeCl_3$ (2 g.) and *o*-cresol (10 g.) heated 2 hrs. at 110-20°, poured in 1% NaOH (400 cc.), filtered, the residue (product + Fe_2O_3) digested at 50° with dil. HCl, treated with Me_2CO , poured into dil. HCl, ppts. 2.3 g. of bis(hydroxymethylphenyl)hydrorubber (III), brown, m. 165-78°, sol. in alkalis. III (0.5 g.) heated in 20% KOH (15 cc.) at 50°, with $BaCl_2$ (1 g.), filtered, dissolved in Me_2CO and repptd. by pouring into dil. KOH yields 0.75 g. of the *dibenzoate deriv.* of III, yellow-brown, m. 190-5°. Similarly were prepd. from *m*- and from *p*-cresol the corresponding bis(hydroxymethylphenyl)hydrorubbers (IV), with properties similar to those of III. I (5 g.), $FeCl_3$ (2.5 g.) and resorcinol (15 g.) heated 2-3 hrs. at 120-30°, $EtOH$ added, poured into dil. HCl and purified several times by pptn. with dil. HCl from Me_2CO , yields bis(dihydroxyphenyl)hydrorubber (IV), brown, does not m. below 300°, sol. in alkalis. Tetrahenzoate deriv., yellow-brown, m. 210-50°, insol. in alkalis. I (5 g.), $FeCl_3$ (2.5 g.) and pyrogallol (15 g.) heated 4-5 hrs. above the m. p. of pyrogallol, dissolved in $EtOH$, poured into dil. HCl at 50° gives a product the yield of which is 1.5-2.0 times that corresponding to bis(trihydroxy-

phenyl)hydrorubber, indicating that it is a mixt. which was not sepd. but which probably contained a higher condensation product. The behavior of the mixt. indicated that it contained in part *bis(trihydroxydiphenyl)hydrorubber*, sol. in alkalis. I (5 g.), FeCl_3 (2.5 g.) and anisole (20 g.) heated 4-5 hrs. at $110-20^\circ$, dild. with C_6H_6 , filtered, poured into EtOH contg. HCl and the ppt. purified from C_6H_6 -EtOH, yields 3.75 g. of *bis(p-methoxyphenyl)hydrorubber*, brown, m. $150-60^\circ$ (cf. Fisher, Gray and McCollm, *loc. cit.*), does not lower the f. p. of C_6H_6 , insol. in alkalis. I (5 g.), FeCl_3 (2.5 g.) and phenetole (20 g.) heated at $110-20^\circ$, dild. with C_6H_6 , filtered, poured into EtOH contg. HCl and the ppt. purified from C_6H_6 -EtOH, gives 3.5 g. of *bis(ethoxyphenyl)hydrorubber*, gray-brown, m. $210-5^\circ$, does not lower the f. p. of C_6H_6 . I (5 g.), FeCl_3 (2.5 g.) and $\alpha\text{-C}_{10}\text{H}_7\text{OMe}$ (20 g.) heated at $110-20^\circ$, extd. with C_6H_6 , evapd. *in vacuo*, the residue dissolved in Me_2CO and pptd. with EtOH or petr. ether, yields 5 g. of *bis(methoxynaphthyl)hydrorubber*, yellow-brown, m. $215-25^\circ$. Guttapercha dibromide (V) (2.5 g.), FeCl_3 (0.5 g.) and PhOH (10 g.) heated 4 hrs. at $110-20^\circ$, dild. with EtOH, filtered, poured into dil. HCl, the ppt. dissolved in Me_2CO and repptd. by petr. ether, yields 2.4 g. of *bis(p-hydroxyphenyl)hydroguttapercha*, brown, m. $170-5^\circ$ (decompn.), amorphous (judged by röntgenographic examn.), sol. in alkalis. *Dibenzoate deriv.*, prepd. by the Schotten-Baumann reaction, yellow-brown, m. $190-5^\circ$, does not lower the f. p. of C_6H_6 , insol. in alkalis. V (2.5 g.), FeCl_3 (0.5 g.) and *m*-cresol (10 g.) heated 4 hrs. at $110-20^\circ$, dild. with EtOH, poured in dil. HCl at 50° and the ppt. twice purified by pptn. by dil. HCl from soln. in Me_2CO , yields 2.4 g. of *bis(hydroxymethylphenyl)hydroguttapercha*, black-gray, m. $150-60^\circ$, sol. in alkalis. *Dibenzoate deriv.*, yellow-brown, m. $175-85^\circ$, insol. in alkalis. Similarly were prepd. from *o*- and *p*-cresol the corresponding *bis(hydroxymethylphenyl)hydroguttapercha* S, with similar properties. V (2.5 g.), FeCl_3 (0.5 g.) and resorcinol (11 g.) heated 4 hrs. at $120-30^\circ$, EtOH added, filtered, poured in aq. NaOH (5 g.), the ppt. redissolved and repptd. several times in the same way, yields *bis(dihydroxyphenyl)hydroguttapercha*, brown-black, does not m. up to 300° , sol. in alkalis. *Dibenzoate deriv.*, yellow, m. $195-200^\circ$, insol. in alkalis. Since the reaction products contained free OH groups, condensation took place on CH groups, and since with simple compds. of low mol. wt. condensation always takes place preferably in *p*-position to an OH group (cf. Staudinger and Widmer, *C. A.* 19, 908), it may be assumed by analogy that the same type of condensation is involved in the rubber derivs., thus:



II. Disazo derivatives of dihydroxy- and of tetrahydroxyphenylhydrorubber. *Ibid* 539-43.—The object was to det. whether hydroxyphenyl residues bound to paraffin chains in colloidal mols. react with diazonium salts. *p*-Dihydroxyphenylhydrorubber (I), (2.54 g.), 2% NaOH (50 cc.) and Na_2CO_3 (5 g.) treated at 0° with PhN:NCl soln. (corresponding to 1.86 g. PhNH_2), let stand 24 hrs. at 0° , warmed to 50° , acidified with HCl, filtered, the residue washed with hot water dissolved in PhMe and repptd. with petr. ether, yields 4.2 g. of *disazo deriv.* $\text{C}_{29}\text{H}_{26}\text{N}_4\text{O}_2$, brown, m. $205-10^\circ$ (decompn.), amorphous (judged by x-ray examn.), difficultly sol. in alkalis.



From the same quantity of I and the corresponding quantity of $p\text{-O}_2\text{NC}_6\text{H}_4\text{N:NCl}$ was prepd. 4.5 g. of *disazo deriv.* $\text{C}_{29}\text{H}_{24}\text{N}_6\text{O}_6$, brown-red, amorphous, m. $260-70^\circ$, also

formed when twice the proportion of $p\text{-O}_2\text{NC}_6\text{H}_4\text{N}:\text{NCl}$ is used, difficultly sol. in alkalis. I diazotized in a similar way with diazonaphthionic acid, warmed to 40° , the free acid pptd. with concd. HCl, dissolved in alkali and repptd. by HCl, gives the corresponding *disazo deriv.*, black-gray, sol. in alkalis. A similar reaction is obtained with I and diazotized sulfanilic acid, though the free acid is pptd. only by very concd. HCl and NaCl. Diazotized benzidine and I form their corresponding *disazo deriv.*, brown. Bis(dihydroxyphenyl)hydrorubber (2.88 g.), 4% NaOH (50 cc.), Na_2CO_3 (5 g.) treated at 0° with $p\text{-O}_2\text{NC}_6\text{H}_4\text{N}:\text{NCl}$ (corresponding to 2.76 g. $p\text{-O}_2\text{NC}_6\text{H}_4\text{NH}_2$), let stand 1 hr., warmed to 50° , acidified, the ppt. washed and purified by pptn. in PhMe by petr. ether, gives 4.9 g. of the *disazo deriv.*, $\text{C}_{28}\text{H}_{24}\text{O}_8\text{N}_6$, brown, m. $210\text{--}5^\circ$ (decompn.), difficultly sol. in alkalis. C. C. DAVIS

Aging of soft rubber goods. R. F. TENER, W. H. SMITH AND W. L. HOLT. Bur. of Standards, *Tech. Paper No. 342*, 353–84 (1927).—To study the influence of light, heat, O, moisture, compn. and degree of vulcanization on the rate of deterioration of rubber goods, 4 representative and widely different rubber mixts. were aged under controlled conditions and the rate of deterioration was detd. Changes in tensile strength and in some cases changes in the Me_2CO ext. and combined S served as a measure of the deterioration. The method and technic, which are described in detail and illustrated, included exposure to (1) outdoors with no protection; (2) outdoors but in darkness; (3) outdoors under glass; (4) outdoors under glass and *in vacuo*; (5) outdoors under slightly colored glass *in vacuo*; (6) indoors to ordinary storage conditions; (7) dry air at 70° ; (8) moist air at 70° ; (9) normal air at 70° ; (10) O at 70° , 80° and 90° and (11) N at 70° , 80° and 90° . The influence of cure was in turn detd. by testing the 4 mixts. when uncured, when cured to the max. tensile strength and when overcured. Several general conclusions are derived from the exptl. work. All of the conditions are conducive to deterioration, but different rubber mixts. do not have the same relative resistance to the various influences, one mixt. being for instance relatively resistant to heating but sensitive to light, while another is relatively sensitive to heating but insensitive to light. As was to be expected, mixts. deteriorated as a result of oxidation faster in O than in air and faster in air than in N. Likewise they deteriorated faster in light than in darkness, and the higher the temp. the faster they deteriorated. *In vacuo*, sunlight formed a hard brittle coating which was insol. in common org. solvents and which contained more combined S than the unexposed and still elastic interior (cf. Williams, *C. A.* 20, 2093). For a given type of mixt., the darker the color the greater was its resistance to light, e. g., an uncolored mixt. showed a 5-fold increase in life in sunlight when it was blackened by incorporating 2% C black. In general the effect of light was more localized than that of O or of heat, and in most cases, but not in all, deterioration by light was manifest as a surface cracking. The presence of moisture did not materially alter the rate of deterioration in air at 70° . The changes in Me_2CO ext. and in combined S depended upon the conditions, the Me_2CO ext. increasing from oxidation and the combined S increasing through after-vulcanization, the first change being induced by O, and the second by heating. The state of cure had a marked effect on the aging, and for each mixt. there was a cure at which the resistance to the various influences was greatest. The effect of the state of cure was most marked in rubber-S mixts., for in this case overcured samples deteriorated rapidly regardless of the conditions. In mixts. contg. accelerators the rate of deterioration did not depend so much upon the state of cure. The results obtained with the *accelerated aging tests* did not in all cases agree with those obtained by natural aging, but such tests are of definite use in forecasting the behavior of rubber mixts. when stored in the usual way. Any quant. comparison, however, between natural and artificial aging is necessarily based on an indefinite standard, since natural aging has not been, as it should be, standardized. C. C. DAVIS

Aging properties of rubber coagulated with formic acid. R. RIEBL. *Arch. Rubber-cultur* 11, 354–66 (1927). (In abridged form in English 367–9.)—The expts. complete those already described (cf. *C. A.* 20, 312). After 2–3 yrs. raw rubber coagulated with HCO_2H was in the same condition as similar rubber coagulated with AcOH. The use of an excess of HCO_2H did not impair the good aging properties. Likewise there was no material difference after aging between the vulcanized samples prepd. from rubber coagulated with HCO_2H and those from rubber coagulated with AcOH. The use of HCO_2H in place of AcOH has, therefore, no disadvantage from an aging standpoint. C. C. DAVIS

The production of raw rubber. W. C. G. MEWES. *Z. Ver. deut. Ing.* 71, 1254–6 (1927).—An illustrated description of modern methods. C. C. DAVIS

Isolation of the natural oxidation inhibitors of crude Hevea rubber. H. A. BRUSON,

L. B. SEBRELL AND W. W. VOGT. *Ind. Eng. Chem.* **19**, 1187 91(1927); cf. Dinsmore, *C. A.* **21**, 194.—By means of a systematic scheme of sepi. and analysis, several hitherto unknown components were isolated from the Me₂CO ext. of raw rubber and 3 of them proved to be antioxidants. The ability of the substances to protect against oxidation was detd. by adding them to a rubber latex contg. Me₂CO-extd. rubber and no other ingredients with any protective action: Quebrachitol, *D*-valine, phytosterol, and other substances isolated by Whitby, Dohd and Yorton (cf. *C. A.* **20**, 3099) were first sepd., but none of these exhibited any protective action and the investigation was continued, the Me₂CO ext. being extd. with water, the aq. ext. neutralized and extd. with Et₂O, the water-insol. portion saponif., the unsaponifiable portion extd. with Et₂O and the new substances isolated from it. From the Et₂O ext. of the neutralized water ext. was obtained a substance with a strong reducing action and apparently a mixt. of phenols and ketones. It had some protective action against oxidation. From the unsaponifiable portion of the water-insol. residue of the Me₂CO ext. were isolated 5 substances: (1) *n*-octadecyl alc.; (2) the compd. C₂₇H₅₂O₂, probably a deriv. of phyto-sterol, reddish, viscous, odorless oil, b_p 258-60°, *n*_D²⁰ 1.5395, optically inactive, insol. in water and aq. alkalis, turned dark in air, gave the Salkowski and Tshugajeff reactions for sterols, gave a red to red-brown instead of a blue with the Whitby and Liebermann-Burchard reactions for sterols, was a very powerful antioxidant, reacted with Ac₂O and lost its antioxidant power, could be hydrogenated in EtOH with Pt to a hydrogenation compd. having no antioxidant properties, *α*-date, light red oil, *n*_D²⁰ 0.9°, (3) the compd. C₁₅H₂₄O, light yellow oil with intense cedar odor, b_p 105.7°, gave reactions of ketones and had no antioxidant power, (4) the compd. C₁₀H₁₆, light yellow oil with orange odor, b_p 210.5°, d₄²⁰ 0.8924, had no antioxidant power, and (5) the compd. C₂₀H₃₆O, reddish oil too impure to obtain a sharp b. p., gave reactions of sterols, had some antioxidant power, which disappeared on acetylation. Attempts to identify this substance led to the prepn. of the hitherto unknown *lanoleic alc.* in 40% yield by applying the method of Bouveault and Blanc (*Compt. rend.* **136**, 1676; **137**, 60(1903)), freezing below 0°, b_p 203°, *n*_D²⁰ 1.4615, d₄²⁰ 0.8586, oxidized in air, accelerated the oxidation of rubber and gave with Br liquid and solid bromides. Tests of the antioxidant power of oleic alc., chlorophyll, catosene, the crude distn. products of rubber, the unsaponifiable portion of cottonseed oil, stearic oil and balata resin, the ultra-violet radiation products of cholesterol and phytosterol, the C₂₇H₅₂O₂ deriv. of diacetylpentane, and chole-sterol and phyto-sterol ozonides, showed them all to be lacking in antioxidant power. Raw rubber is immune to oxidation only when the natural antioxidants are present, and in importance they are comparable to chlorophyll, vitamins, and other biol. active substances. C. C. DAVIS

Some remarks on antioxidants and rubber. GUSTAVE BERNSTEIN. *Rev. gén. caoutchouc* **1927**, No. 34, 3.—In the reference to prevent discussions of the priority of discovery and application of antioxidant, (cf. Mooren, *C. A.* **21**, 2816), attention is called to the rubberized cloth protected by the action of tannin and hydroquinol which was exhibited in London in 1911, to the patent of Helbronner (*French patent* 509,667 (1919)) and to papers by Fickensley. C. C. DAVIS

Some remarks on antioxidants and rubber. (Reply to Gustave Bernstein.) CHARLES MOUREU AND CHARLES DETRAISE. *Rev. gén. caoutchouc* **1927**, No. 34, 3-4, cf. preceding abstr.—Polémicd. Priority is claimed for the use of antioxidants to improve the aging of rubber, and the paper of Helbronner and Bernstein (*C. A.* **17**, 3625) is quoted to prove that the latter had formerly held the same view. The Helbronner patent does not consider the continuous and virtually catalytic action of disproportionately small quantities of antioxidants. C. C. DAVIS

Stearic acid as a rubber-compounding ingredient. W. B. WIEGAND. *Can. Chem. Met. J.* **21**, 211-12; *India Rubber J.* **74**, 488 9(1927).—A review and description of the source, method of production and physical properties of stearic acid, and the results obtained with it in rubber compounding. The proportion of stearic acid to be used depends upon various factors, such as the softening desired, the pigment to be dispersed, the particular accelerator, the proportion of ZnO present and the type of rubber used. Despite its general adaptability, it must be used with caution in some work where mixts. contg. it are allowed to stand, for the oleic acid present in the usual com. grades tends to "bloom" and render the surfaces non-adhesive. C. C. DAVIS

Rubber tests for non-experts. T. E. H. O'BRIEN. *India Rubber J.* **74**, 421-4 (1927).—A description, for those not versed in the technology of rubber, of the properties of rubber and standard methods of testing. C. C. DAVIS

The characterization and testing of reclaimed rubbers. PAUL ALEXANDER.

India Rubber J. **74**, 413-5(1927).—An English version of a previous article (*C. A.* **21**, 1374). C. C. DAVIS

Soft rubber filter-press plates and frames. H. E. FRITZ AND J. H. CLARK, JR. *Ind. Eng. Chem.* **19**, 1151(1927).—Expts. show that semi-hard rubber of suitable compn. is superior in several respects to other materials for the parts of a filter-press which are in contact with the corrosive liquid. This use extends to a wide variety of corrosive liquids, a list of which is included, with the max. temp. and concn. where the use of rubber was found practicable. C. C. DAVIS

Use of perchloric acid as oxidant for the determination of sulfur in rubber. ERNEST KAHANE. *Ann. chim. anal. chim. appl.* **9**, 261-4(1927).—See *C. A.* **21**, 2817. W. T. H.

Balata. M. TILLINAC. *Rev. gén. caoutchouc* **1927**, No. 34, 37-40.—The properties of balata latex and of the gum and the uses of the latter are described. C. C. D.

Explanatory notes on vulcanization testing of rubber. T. E. H. O'BRIEN. *Trop. Agr. (Ceylon)* **69**, 13-9(1927).—Four tables give data obtained by the Ceylon Rubber Research Scheme on the effect of Na_2SiF_6 and of *p*-nitrophenol upon rubber. A. L. MEHRING

Vulcanization and devulcanization of rubber. PAUL BARY. *Rev. gén. caoutchouc* **1927**, No. 34, 10-12.—Present knowledge regarding the chem. combination of S and rubber, the structure of the rubber mol. and the hydrogenation of rubber are discussed. C. C. DAVIS

The vulcanization of rubber by sulfur. F. BOIRY. *Caoutchouc & gutta-percha* **24**, 13,476-7, 13,510-11, 13,546-8, 13,618(1927); cf. *C. A.* **19**, 1964; **21**, 1375.—An extended discussion of past research, in conjunction with new expts., leads to certain general conclusions. Vulcanization is the result of 3 phenomena: (1) chem. combination of S and rubber with formation of addn. compds.; (2) polymerization or aggregation of these addn. compds., and (3) depolymerization of the rubber through external influences. Vulcanization is essentially a result of (1) and (2). Depolymerization, which always takes place during vulcanization by S, is only a "parasitic" phenomenon, and is in no way indispensable to the processes designated (1) and (2). It is manifest in hot and in cold vulcanization in the presence of an ultra-accelerator. In the latter case, however, it is less pronounced and its partial absence under these conditions accounts for the superior phys. properties of rubber vulcanized with an ultra-accelerator. It is the phenomenon of aggregation or polymerization which accounts for the characteristic phys. properties of vulcanized rubber, such as its insol., elasticity and rigidity. This aggregation can, however, progress only when chem. combination of S and rubber has already taken place. In vulcanization of rubber in the solid state, all 3 phenomena occur less simultaneously, whereas in vulcanization in soln., polymerization does not occur and occurs only to a limited extent at the most, and becomes complete only after removal of the solvent. Even in dry vulcanized rubber, polymerization is incomplete, and it continues after vulcanization, the phenomena of aging being at least in part a result of this continued aggregation. The latter does not take place among components of the same chem. compn., e. g., between mols. of rubber more or less sulfurated and those of unsulfurated vulcanized rubber, but only among products having the same or very nearly the same chem. compn. Aggregation probably begins as soon as 1 atom of S has combined with a mol. of rubber to form the compd. $(\text{C}_6\text{H}_8)_n\text{S}$. Vulcanization as represented by the compd., and in general by rubber with a low S content, is clearly evident only when the rubber has not been depolymerized by mech. treatment or by heat. Though the combination of S into the rubber mol. is indispensable for the process of aggregation, it is not a condensing agent which unites through its primary valences the mols. of rubber. Aggregation is rather a result either of adsorption or of an exchange of secondary valences between the S and the rubber mols. All that can be said is that sulfurated rubber has a greater tendency to aggregate than has unvulcanized rubber, and the higher the combined S the greater this tendency. Vulcanized rubber is then formed of components, the chem. compus. of which are nearly the same. Because of its high mol. wt. and the great no. of ethylene bonds which it contains, the rubber mol. can give numerous sulfurated derivs. Though all the rubber reacts with S during vulcanization, it is improbable that all the mols. react in the same way, and if in some mols. the n double bonds satd. by S, in others there may be $n-1$ or $n+1$. These components are grouped in complexes of more or less high order. Those of the highest order in which the components richest in S predominate, have a weak affinity for solvents. Those of not so high an order and richer in less sulfurated components are soluble and are responsible for the swelling of vulcanized rubber. In this connection the fraction which is extractable with solvents usually has a lower S content than rubber

which is insol. The forces which keep the mols. of vulcanized rubber firmly united are on the one hand the forces which are active in the unvulcanized rubber, and on the other hand are the forces which are active in the combination of S and rubber. Rubber is probably a 2-phase system in which under certain conditions it is possible to sep. a liquid phase and an elastic solid phase. The latter is formed of complexes of a higher order, and the liquid phase of complexes of a lower order. C. C. DAVIS²⁶

The molding and vulcanization of rubber articles. H. WILLSHAW. *Chemistry & Industry* 46, 760-4, 783-5 (1927); cf. C. A. 21, 671. —A general description, with illustrations and diagrams, of modern equipment with the principles and technic involved. C. C. DAVIS

Some accelerator characteristics as revealed by coefficients of vulcanization. A. F. HARDMAN AND F. L. WHITE. *Ind. Eng. Chem.* 19, 1037-40 (1927). —Whereas in a rubber-S mixt., combination of S proceeds at a uniform rate nearly to exhaustion, this is not true when org. accelerators and ZnO are also present. Tests show that the effect depends upon the particular accelerator, for in cases where the latter is decompd. during vulcanization, the rate of combination of S decreases with time, and with accelerators which are stable during vulcanization the rate of combination is similar to that in a rubber-S mixt. Between these extreme cases are found the majority of important accelerators, the combined S curves indicating progressive changes in the accelerating power as the time of vulcanization increases. The *stable group* is exemplified by hexamethylenetetramine and triphenylguanidine, the *transient group* by Zn ethylxanthate and Pb dithiofuroate, and the *intermediate group* by diphenylguanidine, tetramethylthiuram monosulfide and Zn dithiocarbamate. C. C. DAVIS

A new light factice for hot and cold cures which does not react with accelerators. RUDOLF DITMAR. *Chem. Ztg.* 51, 599 (1927). —A new white factice ("Gloria" made by Georg Grandel, Augsburg) made with S_2Cl_2 is described. It contains no active Cl, is acid-free and is completely saponifiable. It combines the stability of brown factices with a bright yellow color. It may be used in large proportions, e. g., 30%, in rubber mixts. without impairing the quality, and around 20-25% it has a reinforcing action. Because it contains no active Cl, it does not inhibit the full activity of org. accelerators and does not influence the aging adversely. C. C. DAVIS

C black (U. S. pat. 1,643,736) 18.

Rubber compound. C. ELLIS and N. BOEHMER. Can. 273,676, Sept. 6, 1927. A chlorine-fluxed chlorinated rubber contains in excess of $\frac{2}{3}$ of its wt. of combined Cl_2 .

Bituminous composition containing rubber. J. CAMPBELL. Brit. 263,028, May 29, 1926. A mixt. for spraying roads, coating Fe or wood, use in roofing, etc. is made by boiling together rubber 70 and bitumen 30 parts, with or without small proportions of pitch, resin, S, rubber solvent or soln., plaster of Paris or fibrous material.

Treating rubber latex. H. W. KELLEY and WM. D. WOLFE. U. S. 1,644,730, Oct. 11. Rubber latex contg. NH_3 is treated with H_3BO_3 , borax or other compd. of B_2O_3 of suitable character and with a polyhydroxy compd. such as dextrose or glycerol in which the OH groups are attached to adjacent C atoms. This treatment serves to remove ammoniacal odor.

Forming-seamed hollow rubber articles. R. T. GRIFFITHS. U. S. 1,644,122, Oct. 4. Mech. features.

Vulcanizing rubber. C. W. BEDFORD. U. S. 1,645,084, Oct. 11. Reaction is effected between S 32 and *p*-phenylenediamine 108 parts, suitably at a temp. of about 180-200° in order to form an accelerator. Other N-contg. accelerators also may be heated with S.

Vulcanization. J. TEPPEMA. Can. 274,450, Oct. 4, 1927. The vulcanization of rubber is accelerated by a halogen deriv. of a mercaptoarylthiazole.

Vulcanization. L. B. SEBRELL. Can. 274,446, Oct. 4, 1927. An aldehyde aromatic amine reaction product, part or all of the aldehyde reagent being of an unsatd. aliphatic character, is used as an accelerator of vulcanization. Cf. C. A. 21, 3768.

Vulcanization. L. B. SEBRELL. Can. 274,445, Oct. 4, 1927. A vulcanizing agent is mixed with rubber and there is incorporated in the mixt. a product formed by the condensation of an aldol with an amine, together with an activator, and heat is applied. Cf. C. A. 21, 3768.

Apparatus for vulcanizing inner tire tubes. O. J. KUHLE. U. S. 1,644,678, Oct. 11.

Apparatus for making continuous sheets of rubberized felted material. WM. G. O'BRIEN. U. S. 1,645,068, Oct. 11.

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("P" before a page number indicates "Patent")

NOTE.—In the transliteration of names originally written in Russian, the system followed so far is possible is that of *Nature* (Feb. 27, 1890), in which *v* is used instead of the *w* or *f* of other spellings; *sch* instead of *sch*, *ch* instead of *tch*, *i* instead of *j* or *y*, etc. Thus Pavlov, not Pawlow, Chugaev, not Tschugaeff. To make quite sure, users of the index should in such a case look under both spellings.

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- Zwet, J. K. van der.** Influence of activated carbons on the pH and the inversion of sugar solns., 1563.
- Zviagincev, O. E.** See Zvyagintzev, O. E.
- Zwicky, F.** Theory of sp. heats of soln., 1399; phenomena depending on the change of elastic frequencies in solid bodies with pressure, 1750; reflection of electrons from crystal lattices, 3504.
- Zwicky, J.** App. for producing oil gas, P 647, 1547.
- Zwicker, C.** Thermionic emission of W, Mo, Th, Zr and Hf, 1230; phys. properties of Mo at high temps., 2081.
- Zwikker, J. J. L.** Solutio chloreti ferrici and solutio Leras, 2957; the jubilee of Dr. Hofman, 3102.
- Zwilling, A.** See Grassmann, B.
- Zwilling, G.** See Macheboeuf, M.
- Zwilling, Mme. L.** See Grassmann, B.
- Zwortkin, V. K.** Thermocouple, P 3772.
- Zworykin, V.** Electrolytic conduction of K through glass, 3152.
- Zwoyer, E. B. A.** Briquetting coal dust or other loose materials, P 815; carbonizing fuel briquets, P 2551.
- Zyl, J. P. van.** P deficiency in S. African soils and vegetation, 2161.

SUBJECT INDEX

KEY

In using this index the following should be borne in mind:

1. **Subjects**, not words, have been indexed.
2. **Abstracts**, not merely their titles, have been considered in indexing.
3. The small **superior numeral** which accompanies each page number designates the fraction of the page in ninths in which the subject being indexed is first considered. The printed matter only, exclusive of page headings, has been thus subdivided.

4. "P" before a page number indicates that the abstract is of a **patent**.

5. The **alphabetizing of index headings** has been done on the basis first of that part which comes before the comma in such headings as *Copper*, *metallurgy of* and *Phenol*, *p-nitro*-. E. g., these headings come before the headings *Copper compounds* and *Phenol condensation products*, respectively.


6. **Organic compounds** are indexed on the basis of "parent compounds," or more accurately, "index compounds" (see Introduction), the names of substituent radicals following in alphabetical order. The system of naming organic compounds which has been used is outlined in the Introduction below. Esters and salts of organic acids are, in general, indexed under the names of the acids; notes in the index under the appropriate headings explain the few exceptions.

7. An **asterisk** (*) following the name of an organic compound entered in the index signifies that the name, or numbering, or both are the author's own and may not conform to the system of nomenclature used in this index. This sign is used where it has seemed inadvisable, owing to incomplete information, to attempt to make the name conform to the system, or where the author's name, differing widely from the one given to the compound by the indexer, is given as an extra entry.

8. A **dagger** (†), which follows the names of a few compounds, signifies that the entry is an extra one, the name being only slightly less favored than the one chosen for the other entry. The preferred name can be determined by reference to the Formula Index.

The desirability of making the index readily usable without the need of reference to an elaborate introduction has been held constantly in mind. Although an introduction seems desirable and should be helpful, nevertheless the index is dependent neither on the Key nor on the Introduction. Numerous cross-references are given throughout the index, and notes appear in connection with certain headings. An examination of the Introduction, which follows, should be especially helpful to those interested in looking up organic compounds.

INTRODUCTION

 **General policy.** The indexing of subjects, as opposed to word-indexing, has been emphasized. This avoids omissions, scattering and unnecessary entries; with the abundant cross-references used it means that one should be able to find all of the references on any subject with certainty and with a minimum of effort. The words used as subject headings or in modifying phrases are not necessarily to be found in the abstracts but an expression of the idea suggested will be found within or beginning in the ninth of the page designated by the small superior numeral following the page number. Chemical compounds have been named and entered systematically; the system used is outlined below. All new compounds and all elements, compounds and other substances for which new data are given have been indexed, with the single exception of new compounds for which no names or structures have been given. Such compounds are entered only in the Formula Index. The Subject Index is in no other respect altered because of the Formula Index.

Modifying phrases. In writing such phrases for the entries under any heading the words have been arranged so that the idea considered to be the most important is expressed at the beginning whenever feasible and this procedure, as well as the selection of the words for this purpose, has been governed by numerous formulated general principles and specific rules. *E. g.*, "detection of" has been used consistently whenever correct at the beginning of the modifications in indexing subjects treated from a qualitative analytical point of view, instead of permitting a scattering under such additional phrases as "test for," "reaction for," etc., regardless of what words may have been used in the text. In the case of appropriate headings the selection of first words for modifications has been made on the basis of a definite system of classification. Under a few large headings two or more entries have been made on indexing a subject in a single abstract in case two or more ideas could be used equally well to start the modifying phrase. In alphabetizing modifying phrases prepositions at the beginning have been ignored.

References to fractions of the page. One can readily estimate ninths of a page with considerable accuracy by placing the fore or middle finger one-third of the distance from the top of the printed matter on the page and the thumb one-third of the distance from the bottom, a procedure very easily carried out.

Inorganic compounds. Simple inorganic compounds are entered under the usual names. In indexing compounds of iron, gold, copper and tin such headings as *Iron sulfates*, under which the "ous" and "ic" salts are entered, have been used rather than headings beginning with "ferric(ous)," "auric(ous)," "cupric(ous)," or "stannic(ous)." Acid salts, such as NaH_2PO_4 , are entered under such headings as "*Sodium phosphates*." With the exception of a few common compounds, such as carbon dioxide and carbon monoxide, compounds of a given element with another or with a definite radical, which differ only in valence relations, are grouped. *E. g.*, the various oxides of nitrogen are grouped under the heading "*Nitrogen oxides*" and classified there. Complex inorganic compounds which cannot be given definite names satisfactory for indexing are usually indexed under the heading which represents the class of compounds concerned and under a heading of the type *Nickel compounds*, depending on what the significant element is. *E. g.*, dichlorotetraamminecobaltic chloride would be indexed under "*Ammino compounds*" and under "*Cobalt compounds*." The Formula Index, which follows the Subject Index, should be particularly helpful in locating complex compounds.

Organic compounds. The system used for naming and indexing organic compounds is the same as that in use starting with the 1916 volume. An explanation of it by

Austin M. Patterson and Carleton E. Curran, who are its originators, has appeared in another journal of the Society.¹ The system is based on existing usage and follows this as far as is practicable, so that a great many familiar names are unaffected. Only the general principles will be given here, but in the index itself will be found abundant cross references and also notes under *Alcohols*, *Ketones*, etc., indicating how compounds of these classes are named.

1. The "chief function" of a compound is expressed in the main part of the name wherever possible, and not as a substituent, thus: Pyrrolecarboxylic acid, not carboxypyrrole; ethyl alcohol or ethanol, not hydroxyethane; pentanone, not ketopentane.

2. In compounds of mixed function, the chief function is determined from the following order of precedence:² "onium" compounds, acid (carboxylic first), acid halide, amide, imide, aldehyde, nitrile, ketone, alcohol, phenol, mercaptan, amine, imine, ether, sulfide (and sulfoxide and sulfone). Thus, hydroxybenzonitrile, not cyanophenol; aminophenol, not hydroxyaniline.

3. A multiple chief function is expressed where feasible as -diol, -dicarboxylic acid, etc., rather than as hydroxy-ol, carboxy-acid, etc. But amino and imino groups attached to cyclic bases are treated as substituents; as, aminopyridine.

4. The index compound should be as large, and the substituents as small, as is practicable in conformity with the above rules; as, ethylbenzene, not phenylethane. But such names as diphenylethane and triphenylcarbinol are exceptions. When the chief function is in a side chain attached to a complex nucleus, "additive" names are preferred in order to harmonize 1 and 4; thus, naphthaleneacetic acid, not naphthylacetic acid (with the result that the compound is indexed with other naphthalene derivatives instead of under acetic acid; see 5).

5. The main part of the name with its functional ending, if any, is placed first in the index, the names of substituents following; thus, chloroacetic acid would appear in the index as *Acetic acid, chloro-* and dihydroxyanthraquinone as *Anthraquinone, dihydroxy-*. The part thus placed first is called the "index compound"; it may or may not be the "parent compound" (in the second example the parent compound is anthracene).

6. Names in which two functions are expressed in the index compound, as propanolone, cyclopentanonecarboxylic acid, are avoided, except that a few very common ones, such as phenolsulfonic acid, are used (indicated by cross-references).

7. The names of the substituent radicals in the name of a compound are arranged in alphabetical order; as, benzylethylmethylphenylammonium chloride. The number of radicals of each kind does not affect the order (e. g., *benzyl* precedes *ethyl* no matter how many of each are present); but the compound name of a substituted radical is treated as a unit with its own alphabetic position; thus *dimethylamino*, Me₂N-, follows *benzyl* but precedes *ethyl*. When the complete name has been formed, it is alphabetized as any other word.

8. Parentheses, brackets and even braces are used where necessary to mark off complex radical names.

9. Familiar methods of numbering are employed (Greek letters for acids, alcohols, etc., and for side chains; arabic numerals for Geneva names and rings). The numbering of complex nuclei is shown in the index under the parent compounds; it is practically identical with that of Richter's "Lexikon" so far as that work goes.

10. When two or more numberings are equally indicated that one is chosen which gives the smallest number or numbers for the chief function, then for double bonds if these

¹ Patterson and Curran, *J. Am. Chem. Soc.*, **39**, 1623-38(1917).

² This order is an attempt to express, not the relative chemical importance of functions, but general usage in selecting one of them for the ending of the name.

must be regarded, then for triple bonds, then for point of attachment (doubled molecules), then for substituents.

11. Unnecessary numbers are avoided: thus, in Δ^3 -1-cyclohexanol the 1 is not needed because by the rules in paragraph 10 the OH group is assumed to be in position 1.

12. Numbers in parentheses are used to indicate the position of entering hydrogen necessary to the existence of the compound; thus, 4(3)-quinolone is equivalent to 3, 4-dihydro-4-ketoquinoline.

13. Doubled molecules or radicals are indicated by names commencing with *bi-* (as, *o,o'*-biphenol, biphenyl, $\Delta^{4,4'}$ -bipiperidine). *Bis-* is used for like molecules united by a bivalent radical and for double complex expressions; as, methylenebisphenol, bis(dimethylamino)-.

In using the cross-references, the general nature of many of them should be kept in mind; thus, the reference "*Benzene, ethoxy-*. See *Phenetole*" is applicable not only to this compound itself but to derivatives, which are indexed under it rather than under *Benzene*.

ORGANIC RADICALS

This being the first volume of another ten-year period for *Chemical Abstracts* there are listed below, for convenient reference, practically all organic radicals recognized in the system of indexing used by *Chemical Abstracts*, whether or not they happen to occur in entries in the index for this year. The omissions consist of some of the less frequently occurring names of acid radicals regularly formed from the names of the acids, and occasional bivalent radical names ending in *-ylidene* when regularly formed from names ending in *-yl*. The radicals are listed (1) alphabetically by names and (2) by formulas, the Hill system for arranging the formulas having been used (for an explanation of it, see the "Key" at the beginning of the Formula Index).

BY NAMES

acenaphthenyl $C_{12}H_7$ —(from *acenaphthene*)
acetamido CH_3CONH —
acetenyl = ethinyl
acetimido $CH_3C(NH)$ —
acetonyl CH_3COCH_2 —
acetonilydene CH_3COCH —
acetoxy CH_3COO —
acetyl CH_3CO —
acetylene = $CHCH$ —
acridyl (from *acridine*) $C_{13}H_8N$ —
acrylyl $CH_2=CHCO$ —
adipyl — $OC(CH_2)_4CO$ —
alanil CH_3CHNH_2CO —
alkoxy RO —(any alkyl radical attached by oxygen)
allyl $CH_2=CHCH_2$ —
 β -allyl = isopropenyl
amidoxalyl = oxamyl
amino (amido) H_2N —
amoxy $CH_3(CH_2)_nO$ —
amyl $CH_3(CH_2)_4$ —

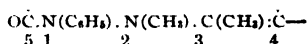
tert-amyl

$$\begin{array}{c} CH_3CH_2 \\ | \\ C \\ | \\ (CH_3)_2 \end{array}$$
 amylidene $CH_3(CH_2)_4CH$ —
 anilino C_6H_5NH —
 anisal *p*- $CH_3OC_6H_4CH$ —
 anisoyl *p*- $CH_3OC_6H_4CO$ —
 anisyl (*o*, *m* or *p*) $CH_3OC_6H_4$ —
 anisylidene = anisal

anthranilo o - C_6H_4 —

$$\begin{array}{c} CO \\ | \\ N \end{array}$$
 anthranoyl o - $H_2NC_6H_4CO$ —

anthraquinonyl (from *anthraquinone*, 2 isomers)
 anthryl (from *anthracene*, 5 isomers)
 anthrylene — $C_{14}H_8$ —(from *anthracene*, 11 isomers)
 antipyril (from *antipyrine*)



arseno - $As:As$ —
 arsino (from *arsinic acid*) $(OH)OAs$ —
 arsinoso $O:As$ —
 arsono (from *arsonic acid*) $(HO)_2OAs$ —
 arsyl H_2As —
 arsyleno HAS —
 asaryl 2,4,5- $(CH_3O)_3C_6H_2$ —
 asparagyl $H_2NCOCH_2CHNH_2CO$ —
 aspartyl — $COCH_2CHNH_2CO$ —
 auro Au —
 azimino (azimido) — $N \cdot NNH$ —
 azido = triazo
 azino = NN —
 azo — $N \cdot N$ —

azoxy — NON —
 benzal C_6H_5CH —
 benzamido C_6H_5CONH —
 benzenyl C_6H_5C —
 benzidino (from *benzidine*)
 $H_2NC_6H_4C_6H_4NH$ —
 benzimidazolyl (from *benzimidazole*) C_7H_5N —
 benzimido $C_6H_4C(NH)$ —
 benzofuryl (from *benzofuran*) C_8H_5O —
 benzohydryl $(C_6H_5)_2CH$ —
 benzohydrylidene = diphenylmethyleno

benzopyranyl (from *benzopyran*) $C_8H_7O(2-\alpha, \text{etc.})$

benzoxazolyl (from *benzoxazole*) C_7H_4NO-

benzoxy C_6H_5COO-

benzoyl C_6H_5CO-

benzoylene $-C_6H_4CO-$

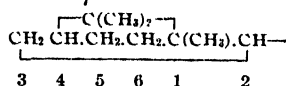
benzyl $C_6H_5CH_2-$

benzylidene = benzal

biphenylene $-C_6H_4C_6H_4-$

biphenylenedisazo $-N.NC_6H_4C_6H_4N:N-$

bornyl (from *borneol*)



boryl O-B-

bromo Br-

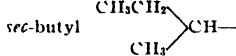
Δ^1 -butenyl $CH_3CH_2CH=CH-$

Δ^2 -butenyl $CH_3CH=CHCH_2-$

Δ^3 -butenyl $CH_2=CHCH_2CH_2-$

butoxy $CH_3(CH_2)_3O-$

butyl $CH_3(CH_2)_3-$



tert-butyl $(CH_3)_3C-$

butylene $-CH_2CH_2CH_2CH_2-[1,4\text{-form}]$

butylidene $CH_3(CH_2)_2CH=$

butyryl $CH_3(CH_2)_2CO-$

camphanyl (from *camphane*, 3 isomers) $C_{10}H_{17}-$

camphoroyl $C_{10}H_{15}O_2-$ (from *camphoric acid*)

camphoryl $C_{10}H_{15}O-$ (from *camphor*)

camphorylidene $C_{10}H_{14}O=$ (from *camphor*)

carbamido $H_2NCONH-$

carbamyl H_2NCO-

carbanilino = phenylcarbamyl

carbuzyl (from *carbazole*, 5 isomers) $C_{12}H_8N-$

carbethoxy CaH_5OOC-

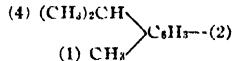
carbomethoxy CH_3OOC-

carbonyl $OC=$

carbonyldioxy $-OCOOC-$

carboxy $HOOC-$

carvacryl



cetyl $CH_3(CH_2)_{14}CH_2-$

chloro Cl-

chloromercuri $ClHg-$

cinnamal $C_6H_5CH=CHCH=$

cinnamenyl = styryl

cinnamyl $C_6H_5CH=CHCO-$

cinnamylidene = cinnamal

cresoxy = toloxy

cresyl (10 isomers) (*o*, *m* or *p*) $(HO)(CH_3)C_6H_4-$

creylene = tolylene

crotonyl $CH_3CH=CHCO-$

cumal *p*-(CH_3)₂CHC₆H₄CH=

cumenyl $(CH_3)_2CHC_6H_4-$

cumidino $(CH_3)_2CHC_6H_4NH-$

cuminal = cumal

cyano NC-

cyclobutyl $CH_2CH_2CH_2CH-$

cyclohexenyl (from *cyclohexene*, 3 isomers) C_6H_7-

cyclohexyl (from *cyclohexane*) $C_6H_{11}-$

cyclohexylidene $CH_2CH_2CH_2CH_2CH_2C=$

cyclopentenyl (from *cyclopentene*) C_5H_7-

cyclopentyl (from *cyclopentane*) C_5H_9-

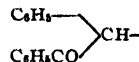
cyclopropyl CH_2CH_2CH-

cymyl (from *cymene*) $C_{10}H_{13}-$

2-*p*-cymyl = carvacryl

3-*p*-cymyl = thymyl

desyl



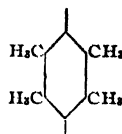
diazo $-N.N-$

diazoamino = azimino

diazoxy $-N(O):N-$

duryl (2,3,5,6) $(CH_3)_4C_6H-$

durylene



epoxy $-O-$ (to different atoms already united in some other way)

ethene = ethylene

ethenyl $CH_2C\equiv$

ethinyl $CH\equiv C-$

ethoxalyl $C_2H_5OOCCO-$

ethoxy C_2H_5O-

ethyl CH_3CH_2-

ethylene $-CH_2CH_2-$

ethylenedioxy $-O(CH_2)_2O-$

ethylidene $CH_3CH=$

fenchyl $C_{10}H_{17}-$, from "fenchyl alcohol" (= 2-fenchanyl)

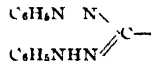
fluoro F-

fluoryl (from *fluorene*, 5 isomers) $C_{13}H_9-$

fluorylidene $C_{13}H_8=$

formamido $HCONH-$

formazolyl



formyl $OCH-$

fural (2 isomers) $O.CH=CH.CH=C.CH=$

furfural = fural

furfuryl = furyl

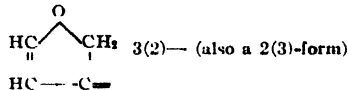
furfurylidene = fural

2-furoyl = pyromucyl

3-furoyl $CH.CH.O.CH.C.CO-$

furyl (2 isomers) $O.CH.CH.CH=C-$

furylidene



geranyl (from *geraniol*) $C_{10}H_{17}-$

glutamyl $-OCCNHCH_2(CH_2)_2CO-$

glutaryl $-OC(CH_2)_3CO-$

glyceryl $-CH_2CHCH_2-$

glycolyl $HOCH_2CO-$

glycyl H_2NCH_2CO-

glyoxyl $OCHCO-$

guaiacyl = *o*-anisyl

guanido $H_2NC(:NH)NH-$

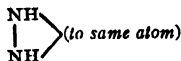
guanyl $H_2NC(:NH)-$

hendecyl $CH_3(CH_2)_{10}-$

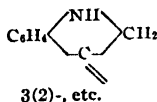
heptyl $CH_3(CH_2)_6-$

hexadecyl = cetyl

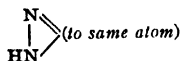
hexyl $\text{CH}_3(\text{CH}_2)_5$ —
homopiperonyl (3,4) $(\text{CH}_2\text{O})_2\text{C}_6\text{H}_5\text{CH}_2\text{CH}_2$ —
hydrazide



hydrazino H_2NNH —
hydrazo — HNNH — (to different atoms)
hydrazono $\text{H}_2\text{NN}=\text{}$
hydroxamino HONH —
hydroximino = isonitroso
hydroxy (hydroxyl) HO —
-idene added to any radical usually means a double bond at point of attachment
imidazolyl (from imidazole, 4 isomers) $\text{C}_3\text{H}_3\text{N}_2$
imino (imido) $\text{HN}=\text{}$
indanyl (from indan, 4 isomers) C_{10}H_7 —
indenyl (from indene, 7 isomers) C_{10}H_7 —
indyl (from indole, 7 isomers) $\text{C}_8\text{H}_6\text{N}$ —
indylidene

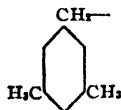


iodo I —
iodoso OI —
iodoxy OI —
isoallyl = propenyl
isoamoxy $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_2\text{O}$ —
isoamyl $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_2$ —
isoamylidene $(\text{CH}_3)_2\text{CHCH}_2\text{CH}=\text{}$
isobutenyl $(\text{CH}_3)_2\text{C}=\text{CH}$ —
isobutoxy $(\text{CH}_3)_2\text{CHCH}_2\text{O}$ —
isobutyl $(\text{CH}_3)_2\text{CHCH}_2$ —
isobutyryl $(\text{CH}_3)_2\text{CHCO}$ —
isocyno $\text{C}:\text{N}$ —
isodiazoo

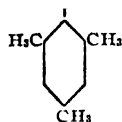


isohexyl $(\text{CH}_3)_2\text{CH}(\text{CH}_2)_3$ —
isoindyl (from isoindole, 4 isomers) $\text{C}_8\text{H}_6\text{N}$ —
isoleucyl $\text{CH}_2\text{CH}_2\text{CH}(\text{CH}_3)\text{CHNH}_2\text{CO}$ —
isonitro $\text{HOON}=\text{}$
isonitroso $\text{HON}=\text{}$
 Δ^1 -isopentenyl $(\text{CH}_3)_2\text{CHCH}=\text{CH}$ —
isophthalal = $\text{HCC}_6\text{H}_4\text{CH}=\text{}$ (m)
isophthalylidene = isophthalal
isopropenyl $\text{CH}_2=\text{C}(\text{CH}_3)$ —
isopropoxy $(\text{CH}_3)_2\text{CHO}$ —
isopropyl $(\text{CH}_3)_2\text{CH}$ —
isopropylidene $(\text{CH}_3)_2\text{C}=\text{}$
isoquinolyl (from isoquinoline, 9 isomers) $\text{C}_9\text{H}_6\text{N}$ —
isothiocyno $\text{S}:\text{C}:\text{N}$ —
isovaleryl $(\text{CH}_3)_2\text{CHCH}_2\text{CO}$ —
isoxazolyl (from isoxazole, 5 isomers) $\text{C}_3\text{H}_2\text{ON}$
keto $\text{O} =$ (to same atom)
leucyl $(\text{CH}_3)_2\text{CHCH}_2\text{CHNH}_2\text{CO}$ —
malonyl — OCCCH_2CO —
menthyl (from menthane): as, 2 p menthyl

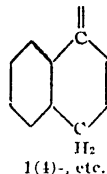
$\text{CH}_3\text{CH}(\text{CH}_2)_2\text{CH}(\text{i-C}_6\text{H}_7)\text{CH}_2\text{CH}$ —
mercapto HS —
mercuri — Hg —
 α -menthyl



2-mesityl



methene = methylene
methenyl $\text{CH}=\text{}$
methionyl $\text{CH}_2(\text{SO}_2)_2$ —
methoxy CH_3O —
methyl CH_3 —
methylene CH_2 —
methylenedioxy — OCH_2O —
methylol = (hydroxymethyl)
naphthal $\text{C}_{10}\text{H}_7\text{CH}=\text{}$
naphthalimido (from naphthalic acid) $\text{C}_{10}\text{H}_6(\text{CO})_2$ —
N—
naphthenyl $\text{C}_{10}\text{H}_7\text{C}$ —
naphthoxy $\text{C}_{10}\text{H}_7\text{O}$ —
naphthoyl $\text{C}_{10}\text{H}_7\text{CO}$ —
naphthyl (1- or 2-) C_{10}H_7 —
naphthylene C_{10}H_6 —
naphthylidene



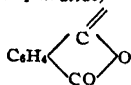
nitramino O_2NNH —
nitrilo N^{\equiv} —
nitro O_2N —
aci-nitro = isonitro
nitroso ON —
norcamphanyl (from norcamphane) $\text{C}_{10}\text{H}_{17}$ —
octyl C_8H_{17} —
oxalyl — OCCO —
oxamido $\text{H}_2\text{NCOCONH}$ —
oxamyl H_2NCOCO —
oximido = isonitroso
oxy — O — (used as a connective, cf. epoxy and keto)
pentamethylene — $\text{CH}_2(\text{CH}_2)_3\text{CH}_2$ —

pentazyl $\text{N}=\text{N}=\text{N}=\text{N}=\text{N}$ —
pentenyl (like butenyl) C_5H_9 —
pentyl = amyl
perimidyl (from perimidine, 8 isomers) $\text{C}_{11}\text{H}_7\text{N}_2$
perthio $\text{S}=\text{S}$ —
phenacyl $\text{C}_6\text{H}_5\text{COCCH}_2$ —
phenacylidene $\text{C}_6\text{H}_5\text{COCCH}=\text{}$
phenanthryl (from phenanthrene, 5 isomers) C_{14}H_9 —
phenanthrylene C_{14}H_8 — (several isomers)
phenenyl C_6H_3 = (s, as-, v-)
phenethyl $\text{C}_6\text{H}_5\text{CH}_2\text{CH}_2$ —
phenetidino $\text{C}_2\text{H}_5\text{OC}_6\text{H}_4\text{NH}$ —
phenetyl (o, m or p) $\text{C}_2\text{H}_5\text{OC}_6\text{H}_4$ —
phenoxy $\text{C}_6\text{H}_5\text{O}$ —
phenyl C_6H_5 —
phenylazo $\text{C}_6\text{H}_5\text{N}=\text{N}$ —
phenylcarbamido $\text{C}_6\text{H}_5\text{NHCONH}$ —
phenylene (o, m or p) C_6H_4 —
phenylenedisazo — $\text{N}:\text{NC}_6\text{H}_4\text{N}$ — (o, m, p)
phenylidene (o or p; p shown below)

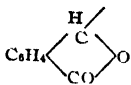
$\text{CH}=\text{CH}(\text{CH}_2)_3\text{CH}=\text{CH}=\text{C}$ —
phenylureido = phenylcarbamido
phosphazo — $\text{N}:\text{P}$ —
phosphono $\text{H}_2\text{O}_2\text{P}$ —

phthalal = $\text{HC}_6\text{H}_4\text{CH}=\text{(o)}$

phthalidene (from phthalide)



phthalidyl



phthalimido $\text{C}_6\text{H}_4(\text{CO})_2\text{N}=\text{(o)}$

phthalyl $\text{—OCC}_6\text{H}_4\text{CO}=\text{(o)}$

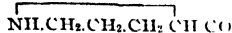
picryl (2,4,6) $(\text{NO}_2)_3\text{C}_6\text{H}_2=\text{(o)}$

piperidyl (from piperidine, 4 isomers) $\text{C}_6\text{H}_{10}\text{N}=\text{(o)}$

piperonyl (3,4) $(\text{CH}_3\text{O})_2\text{C}_6\text{H}_3\text{CH}=\text{(o)}$

piperonylidene (3,4) $(\text{CH}_3\text{O})_2\text{C}_6\text{H}_3\text{CH}=\text{(o)}$

prolyl (from proline)



propargyl $\text{HC}::\text{CCH}_2=\text{(o)}$

propenyl $\text{CH}_3\text{CH}::\text{CH}=\text{(o)}$

propenylidene $\text{CH}_3\text{CH}::\text{C}=\text{(o)}$

propionyl $\text{HC}::\text{CCO}=\text{(o)}$

propionyl $\text{CH}_3\text{CH}_2\text{CO}=\text{(o)}$

propoxy $\text{CH}_3\text{CH}_2\text{CH}_2\text{O}=\text{(o)}$

propyl (n) $\text{CH}_3\text{CH}_2\text{CH}_2=\text{(o)}$

propylene $\text{—CH}(\text{CH}_3)\text{CH}_2=\text{(o)}$

propylidene $\text{CH}_3\text{CH}_2\text{CH}=\text{(o)}$

pseudoallyl = isopropenyl

as-pseudocumyl (2,3,5) $(\text{CH}_3)_3\text{C}_6\text{H}_2=\text{(o)}$

s-pseudocumyl (2,4,5) (o)

σ pseudocumyl (2,3,6) (o)

pseudoindyl (from pseudoindole, 7 isomers)

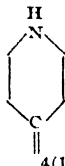
$\text{C}_8\text{H}_5\text{N}=\text{(o)}$

pyranlyl $\text{C}_6\text{H}_4\text{O} (2-\alpha, 2-\gamma, 3-\alpha, \text{etc})$

pyrazolyl (from pyrazole, 4 isomers) $\text{C}_4\text{H}_3\text{N}_2=\text{(o)}$

pyridyl (from pyridine, 3 isomers) $\text{C}_5\text{H}_4\text{N}=\text{(o)}$

pyridylidene



4(1)-

pyrimidyl (from pyrimidine) $\text{C}_4\text{H}_3\text{N}_2=\text{(o)}$

pyromucyl $\text{O}::\text{CH}::\text{CH}::\text{C}::\text{CO}=\text{(o)}$

pyrrolidyl (from pyrrolidine, 3 isomers) $\text{C}_4\text{H}_7\text{N}=\text{(o)}$

pyrrolyl $\text{CH}::\text{CH}::\text{CH}::\text{CH}::\text{N}::\text{CO}=\text{(o)}$

pyrrol (from pyrrole, 3 isomers) $\text{C}_4\text{H}_5\text{N}=\text{(o)}$

quinolyl (from quinoline, 7 isomers) $\text{C}_8\text{H}_6\text{N}=\text{(o)}$

quinonyl (from quinone) $\text{C}_6\text{H}_4\text{O}_2=\text{(o)}$

quinoxalyl (from quinoxaline) $\text{C}_8\text{H}_5\text{N}_2=\text{(o)}$

salicyl (o) $\text{HOC}_6\text{H}_4=\text{(o)}$

salicylal (o) $\text{HOC}_6\text{H}_4\text{CH}=\text{(o)}$

salicylyl (o) $\text{HOC}_6\text{H}_4\text{CO}=\text{(o)}$

selenino $(\text{HO})\text{OSe}=\text{(o)}$

seleno $\text{Se}=\text{(o)}$

selenocyano $\text{NCSe}=\text{(o)}$

selenono $\text{HO}_2\text{Se}=\text{(o)}$

selenonyl $\text{—SeO}=\text{(o)}$

selenyl, $\text{HSe}=\text{(o)}$

semicarbazido $\text{NH}_2\text{CONHNH}=\text{(o)}$

silicono $(\text{OH})\text{OSi}=\text{(o)}$

silicyl $\text{HSi}=\text{(o)}$

silicylene $\text{H}_2\text{Si}=\text{(o)}$

stannyl $\text{H}_2\text{Sn}=\text{(o)}$

stearyl $\text{CH}_3(\text{CH}_2)_{16}\text{CO}=\text{(o)}$

tibono $(\text{HO})_{25}\text{OSb}=\text{(o)}$

styrene $\text{—CH}(\text{C}_6\text{H}_5)\text{CH}_2=\text{(o)}$

styrolene = styrene

styryl $\text{C}_6\text{H}_5\text{CH}::\text{CH}=\text{(o)}$

succinamyl $\text{H}_2\text{NCOCH}_2\text{CH}_2\text{CO}=\text{(o)}$

succinyl $\text{—OCCCH}_2\text{CH}_2\text{CO}=\text{(o)}$

sulfamino $\text{HO}_2\text{SNH}=\text{(o)}$

sulfamyl $\text{H}_2\text{NO}_2\text{S}=\text{(o)}$

sulfhydryl = mercapto

sulino $\text{HO}_2\text{S}=\text{(o)}$

sulfinyl $\text{OS}=\text{(o)}$

sulfo $\text{HO}_2\text{S}=\text{(o)}$

sulfonamido $\text{—SO}_2\text{NH}=\text{(o)}$

sulfonyl $\text{—SO}_2=\text{(o)}$

sulfuryl = sulfonyl

tauryl $\text{H}_2\text{NCH}_2\text{CH}_2\text{SO}_2=\text{(o)}$

telluro $\text{Te}=\text{(o)}$

terephthalal = $\text{HC}_6\text{H}_4\text{CH}=\text{(p)}$

tetramethylene = 1,4-butylene

tetrazyl (from tetrazole, 2 isomers) $\text{CHN}_4=\text{(o)}$

thiazyl (from thiazole, 3 isomers) $\text{C}_2\text{H}_2\text{NS}=\text{(o)}$

thienyl (from thiophene, 2 isomers) $\text{C}_4\text{H}_3\text{S}=\text{(o)}$

thio $\text{—S}=\text{(o)}$

thiocarbonyl $\text{SC}=\text{(o)}$

thiocyano $\text{NCS}=\text{(o)}$

thiohydroxy = mercapto

thiol (S replacing O in OH) of "thio" only
thiono (S replacing O in CO) when required
for distinction

thionyl = sulfinyl

thujyl (from sabinane, attached at 2 positions)
 $\text{C}_{10}\text{H}_{17}=\text{(o)}$

thymyl (from thymol)

$\text{HC}(\text{CH}_3)\text{CH}::\text{CH}::\text{C}(\text{C}_6\text{H}_7)\text{C}=\text{(o)}$

toloxyl (o, m or p) $\text{CH}_3\text{C}_6\text{H}_4\text{O}=\text{(o)}$

toluino (o, m or p) $\text{CH}_3\text{C}_6\text{H}_4\text{NH}=\text{(o)}$

tolyl (o, m or p) $\text{CH}_3\text{C}_6\text{H}_4\text{CO}=\text{(o)}$

α-tolyl $\text{C}_6\text{H}_4\text{CH}_2\text{CO}=\text{(o)}$

tolyl (o, m or p) $\text{CH}_3\text{C}_6\text{H}_4=\text{(o)}$

α-tolyl = benzyl

tolyene (6 isomers) $\text{CH}_3\text{C}_6\text{H}_5=\text{(o)}$

α-tolyene = benzal

triazeno $\text{NH}_2\text{N}::\text{N}=\text{(o)}$

triazinyl (from triazine) $\text{C}_4\text{H}_2\text{N}_4=\text{(o)}$

triazon $\text{N}::\text{N}::\text{N}=\text{(o)}$

triazolyl (from triazole) $\text{C}_2\text{H}_2\text{N}_3=\text{(o)}$

trimethylene $\text{—CH}_2\text{CH}_2\text{CH}_2=\text{(o)}$

tryptophyl (from tryptophan) $\text{C}_{11}\text{H}_{11}\text{ON}_2=\text{(o)}$

tyrosyl (from tyrosine)

p-HOC₆H₄CH₂CHNH₂CO=

undecyl = hendecyl (in sense C₁₁H₂₃)

uramino = carbamido

ureido (by some used synonymously with carbamido)

—NHCONH=

valeryl $\text{CH}_3(\text{CH}_2)_3\text{CO}=\text{(o)}$

valyl (from valine) $(\text{CH}_3)_2\text{CHCHNH}_2\text{CO}=\text{(o)}$

vanillal (3,4) $(\text{CH}_3\text{O})_2(\text{HO})\text{C}_6\text{H}_3\text{CH}=\text{(o)}$

vanilloyl (3,4) $(\text{CH}_3\text{O})_2(\text{HO})\text{C}_6\text{H}_3\text{CO}=\text{(o)}$

vanillyl (3,4) $(\text{CH}_3\text{O})_2(\text{HO})\text{C}_6\text{H}_3\text{CH}_2=\text{(o)}$

veratral (3,4) $(\text{CH}_3\text{O})_2\text{C}_6\text{H}_3\text{CH}=\text{(o)}$

veratroyl (3,4) $(\text{CH}_3\text{O})_2\text{C}_6\text{H}_3\text{CO}=\text{(o)}$

veratryl (3,4) $(\text{CH}_3\text{O})_2\text{C}_6\text{H}_3\text{CH}_2=\text{(o)}$

veratrylidene = veratral

vinyl $\text{H}_2\text{C}::\text{CH}=\text{(o)}$

vinylene $\text{—CH}::\text{CH}=\text{(o)}$

vinylidene $\text{H}_2\text{C}::\text{C}=\text{(o)}$

xanthyl (from xanthene, 6 isomers) $\text{C}_{15}\text{H}_9\text{O}=\text{(o)}$

xyloyl (from xylic acid, 7 isomers) $(\text{CH}_3)_2\text{C}_6\text{H}_3\text{CO}=\text{(o)}$

xylyl (dimethylphenyl) $(\text{CH}_3)_2\text{C}_6\text{H}_4=\text{(o)}$

xylylene $\text{—H}_2\text{CC}_6\text{H}_4\text{CH}_2=\text{(o)}$

BY FORMULAS

- AsH arsylene
 AsHO_2 arsino
 AsH_2 arsyl
 AsH_2O_2 arsono
 AsO arsinoso
 Au auro
 BO boryl
 Br bromo
 CH methenyl
 CHN_4 tetrazyl
 CHO formyl
 CHO_2 carboxy
 CH_2 methylene
 CH_2NO carbamyl
 formamido
 $\text{CH}_2\text{N}_2\text{O}$ ureido
 CH_2O_2 methylenedioxy
 $\text{CH}_2\text{O}_4\text{S}_2$ methionyl
 CH_3 methyl
 CH_3N_2 guanyl
 $\text{CH}_3\text{N}_2\text{O}$ carbamido
 CH_3O methoxy
 CH_3N_3 guanido
 $\text{CH}_3\text{N}_3\text{O}$ semicarbazido
 CN cyano
 isocyano
 CNS isothiocyano
 thiocyano
 CNSe selenocyano
 CO carbonyl
 CO_2 carbonyldioxy
 CS thiocarbonyl
 C_2H ethinyl
 C_2HO_2 glyoxyl
 C_2H_2 acetylene
 vinylene
 vinylidene
 $\text{C}_2\text{H}_2\text{NO}_2$ oxamyl
 $\text{C}_2\text{H}_2\text{N}_3$ triazolyl
 C_2H_3 ethenyl
 vinyl
 $\text{C}_2\text{H}_4\text{N}_2\text{O}_2$ oxamido
 $\text{C}_2\text{H}_3\text{O}$ acetyl
 $\text{C}_2\text{H}_3\text{O}_2$ acetoxy
 carbomethoxy
 glycolyl
 C_2H_4 ethylene
 ethylidene
 $\text{C}_2\text{H}_4\text{N}$ acetimido
 $\text{C}_2\text{H}_4\text{NO}$ acetamido
 glycyl
 $\text{C}_2\text{H}_4\text{O}_2$ ethylenedioxy
 C_2H_5 ethyl
 $\text{C}_2\text{H}_4\text{O}$ ethoxy
 $\text{C}_2\text{H}_5\text{NO}_2\text{S}$ tauryl
 C_2O_2 oxalyl
 C_2HO propiolyl
 $\text{C}_2\text{H}_2\text{NO}$ isoxazolyl
 $\text{C}_2\text{H}_2\text{NS}$ thiazyl
 $\text{C}_2\text{H}_2\text{N}_3$ triazinyl
 $\text{C}_2\text{H}_3\text{O}_2$ malonyl
 C_2H_3 propargyl
 $\text{C}_2\text{H}_2\text{N}_2$ imidazolyl
 pyrazolyl
 $\text{C}_2\text{H}_3\text{O}$ acrylyl
 C_2H_4 propenylidene
 $\text{C}_2\text{H}_4\text{O}$ acetonylidene
 C_2H_5 allyl
 cyclopropyl
 glyceryl
 isopropenyl
 propenyl
 $\text{C}_2\text{H}_5\text{O}$ acetonyl
 propionyl
 $\text{C}_2\text{H}_5\text{O}_2$ carbethoxy
 C_2H_5 isopropylidene
 propylene
 propylidene
 trimethylene
 $\text{C}_2\text{H}_5\text{NO}$ alanyl
 C_2H_7 isopropyl
 propyl
 $\text{C}_2\text{H}_7\text{O}$ isopropoxy
 propoxy
 $\text{C}_4\text{H}_3\text{N}_2$ pyrimidyl
 $\text{C}_4\text{H}_3\text{O}$ furyl
 $\text{C}_4\text{H}_3\text{S}$ thienyl
 $\text{C}_4\text{H}_4\text{N}$ pyreryl
 $\text{C}_4\text{H}_4\text{O}$ furylidene
 $\text{C}_4\text{H}_4\text{O}_2$ succinyl
 $\text{C}_4\text{H}_5\text{NO}_2$ aspartyl
 $\text{C}_4\text{H}_5\text{O}$ crotonyl
 $\text{C}_4\text{H}_5\text{O}_2$ ethoxalyl
 $\text{C}_4\text{H}_5\text{NO}_2$ succinamyl
 C_4H_7 butenyl
 cyclobutyl
 isobutenyl
 $\text{C}_4\text{H}_7\text{N}_2\text{O}_2$ asparagyl
 $\text{C}_4\text{H}_7\text{O}$ buteryl
 isobuteryl
 C_4H_8 butylene
 butylidene
 $\text{C}_4\text{H}_8\text{N}$ pyrrolidyl
 C_4H_9 butyl
 sec-butyl
 tert butyl
 isobutyl
 $\text{C}_4\text{H}_9\text{O}$ butoxy
 isobutoxy
 $\text{C}_6\text{H}_5\text{O}_2$ furoyl
 pyromucyl
 $\text{C}_6\text{H}_5\text{N}$ pyridyl
 $\text{C}_6\text{H}_5\text{NO}$ pyrrolyl
 $\text{C}_6\text{H}_4\text{O}$ fural
 $\text{C}_6\text{H}_5\text{N}$ pyridylidene
 $\text{C}_6\text{H}_5\text{O}$ pyranyl
 $\text{C}_6\text{H}_5\text{O}_2$ glutaryl
 C_6H_7 cyclopentenyl
 $\text{C}_6\text{H}_7\text{NO}_2$ glutamyl
 $\text{C}_6\text{H}_8\text{NO}$ prolyl
 C_6H_9 cyclopentyl
 isopentenyl
 pentenyl
 $\text{C}_6\text{H}_9\text{O}$ isovaleryl
 valeryl
 C_6H_{10} amylidene
 isoamylidene
 pentamethylene
 $\text{C}_6\text{H}_{10}\text{N}$ piperidyl
 $\text{C}_6\text{H}_{10}\text{NO}$ valyl
 C_6H_{11} amyl
 tert amyl
 isoamyl
 $\text{C}_6\text{H}_{11}\text{O}$ amoxy
 isoamoxy
 $\text{C}_6\text{H}_2\text{N}_3\text{O}_2$ picryl
 C_6H_5 phenenyl
 $\text{C}_6\text{H}_5\text{O}_2$ quinonyl
 C_6H_4 phenylene
 $\text{C}_6\text{H}_4\text{N}_4$ phenylenedisazo
 C_6H_5 phenyl
 $\text{C}_6\text{H}_5\text{N}_2$ phenylazo
 $\text{C}_6\text{H}_5\text{O}$ phenoxy
 salicyl

- C_6H_6 phenylidene
 C_6H_5N anilino
 $C_6H_5O_2$ adipyl
 C_6H_9 cyclohexenyl
 C_6H_{10} cyclohexylidene
 C_6H_{11} cyclohexyl
 $C_6H_{12}NO$ isoleucyl
leucyl
 C_6H_{11} hexyl
isohexyl
 C_7H_4NO anthranilo
benzoxazolyl
 C_7H_4O benzoylene
 C_7H_5 benzenyl
 $C_7H_5N_2$ benzimidazolyl
 C_7H_5O benzoyl
 $C_7H_5O_2$ benzoxo
salicylyl
 C_7H_6 benzal
tolylene
 C_7H_6N benzimido
 C_7H_6NO anthranoyl
benzamido
 C_7H_6O salicylal
 C_7H_7 benzyl
tolyl
 $C_7H_7N_2O$ phenylcarbamido
 C_7H_7O anisyl
cresyl
toloxyl
 C_7H_8N toluino
 C_7H_{11} norcamphanyl
 C_7H_{15} heptyl
 $C_8H_4NO_2$ phthalimido
 $C_8H_4O_2$ phthalidene
phthalyl
 $C_8H_6N_2$ quinoxalyl
 C_8H_6O benzofuryl
 $C_8H_6O_2$ phthalidyl
 C_8H_6 isophthalal
phthalal
terephthalal
 C_8H_6N indyl
isoindyl
pseudoindyl
 C_8H_6O phenacylidene
 $C_8H_6O_2$ piperonylidene
 C_8H_7 styryl
 C_8H_7N indylidene
 C_8H_7O phenacyl
toluyl
 $C_8H_7O_2$ anisoyl
piperonyl
 $C_8H_7O_2$ vanilloyl
 C_8H_8 styrene
xylylene
 C_8H_8O anisal
 $C_8H_8O_2$ vanillal
 C_8H_9 phenethyl
xylyl
 C_8H_9O phenetyl
 $C_8H_9O_2$ vanillyl
 $C_8H_{10}NO$ phenetidino
 C_8H_{17} octyl
 C_8H_8N isoquinolyl
quinolyl
 C_8H_7 indenyl
 C_8H_7O benzopyranyl
cinnamyl
 C_9H_8 cinnamal
 C_9H_9 indawyl
 C_9H_9O xyloyl
 $C_9H_9O_2$ homopiperonyl
 $C_9H_9O_2$ veratroyl
 $C_9H_{10}NO_2$ tyrosyl
 $C_9H_{10}O_2$ veratral
 C_9H_{11} cumenyl
mesityl
pseudocumyl
 $C_9H_{11}O_2$ veratryl
 $C_9H_{11}O_2$ asaryl
 $C_9H_{12}N$ cumidino
 $C_{10}H_6$ naphthylene
 $C_{10}H_7$ naphthyl
 $C_{10}H_7O$ naphthoxy
 $C_{10}H_8$ naphthylidene
 $C_{10}H_{12}$ cumal
durylene
 $C_{10}H_{12}$ carvacryl
cymyl
duryl
thymyl
 $C_{10}H_{14}O$ camphorylidene
 $C_{10}H_{14}O_2$ camphoroyl
 $C_{10}H_{16}O$ camphoryl
 $C_{10}H_{17}$ bornyl
camphanyl
fenchyl
geranyl
thujyl
 $C_{10}H_{19}$ menthyl
 $C_{11}H_7$ naphthenyl
 $C_{11}H_7N_2$ perimidyl
 $C_{11}H_7O$ naphthoyl
 $C_{11}H_8$ naphthal
 $C_{11}H_{11}N_2O$ antipyril
tryptophyl
 $C_{11}H_{12}$ hendecyl
 $C_{12}H_6NO_2$ naphthalimido
 $C_{12}H_8$ biphenylene
 $C_{12}H_8N$ carbazyl
 $C_{12}H_8N_4$ biphenylenedisazo
 $C_{12}H_8$ acenaphthenyl
 $C_{12}H_8N_2$ benzidino
 $C_{13}H_8$ fluorylidene
 $C_{14}H_8N$ acridyl
 $C_{14}H_9$ fluoryl
 $C_{14}H_9O$ xanthyl
 $C_{15}H_{11}$ benzohydryl
 $C_{15}H_{11}N_4$ formazyl
 $C_{14}H_7O_2$ anthraquinonyl
 $C_{14}H_8$ anthrylene
phenanthrylene
 $C_{14}H_9$ anthryl
phenanthryl
 $C_{14}H_{11}O$ desyl
 $C_{15}H_{13}$ cetyl
 $C_{18}H_{33}O$ stearyl
Cl chloro
ClHg chloromercuri
F fluoro
HN imino (imido)
HNO isonitroso
HNO₂ isonitro
HNO₂S sulfonamido
HN₂ isodiaz
HN₂O₂ nitramino
HN₂ azimino (azimido)
HO hydroxy (hydroxyl)
HO₂S sulfino
HO₂Se selenino
HO₂Si silicono
HO₂S sulfo
HO₂Se selenono
HS mercapto
HSe selenyl
H₂N amino (amido)
H₂NO hydroxamino

H_2NO_2S sulfamyl
 H_2NO_2S sulfamino
 H_2N_2 hydrazo
 hydrazo
 hydrazono
 H_2N_3 triazeno
 H_2O_2P phosphono
 H_2O_2Sb stibono
 H_2Si silicylene
 H_2N_3 hydrazino
 H_2Si silicyl
 H_2Sn stannyl
 Hg mercuri
 I iodo
 IO iodoso
 IO_2 iodoxy
 N nitrilo
 NO nitroso
 NO_2 nitro

NP phosphazo
 N_2 azino
 azo
 diazo
 N_2O uzoxy
 diazoxy
 N_3 triazo
 N_5 pentazyl
 O epoxy
 keto
 oxy
 OS sulfinyl
 O_2S sulfonyl
 O_2Se selenonyl
 S thio
 S_2 perthio
 Se seleno
 Te telluro

RING INDEX

The following index of *ring complexes* is arranged as shown by the bold-face figures: Class I, with single figures indicating simple rings of 3, 5, etc., members; Class II, two figures denoting double rings of 3 and 4, 3 and 5, etc., members; then the triple and still more complex rings. Under each combination of figures the kind and number of atoms in the ring or rings are expressed in formulas. These formulas are arranged so that their initial rings are in the same order as in the Formula Index (see Key at the beginning of it). If the initial rings are alike the second rings of the formula are considered, and so on. By this means the reader will be able to learn the name used in the index for the simplest parent compound containing any particular ring or combination of rings and by turning to this name in the index he will find the compounds listed and, perhaps, cross references to names of derivatives. Rings which are united but which have no atoms in common (*e. g.*, biphenyl) and "spiro" compounds¹ which are characterized by two rings having but one atom in common are not regarded as ring complexes nor included in this index.

To illustrate: **6,6,6**, $C_4N_2-C_6-C_6$ Benzoquinoxaline
 Phenazine

(1) This designates a complex ring of three components, each of six members; (2) the first is heterocyclic, containing four carbon atoms and two nitrogen atoms and the other two are carbocyclic rings of six atoms each; (3) parent compounds of this configuration will be found in the index under the two names given. If derivatives are indexed a structural formula will be found with the proper numbering and also appropriate cross references to derivs. having other common names, if any such are in the index.

It should be noted that the classification is made with reference to the smallest rings which, placed together, will constitute the plane formula. Thus hexamethylene-tetramine is treated as a 6,6,6, complex although a fourth six-membered ring (composed of atoms from the three six-membered rings) is also present.

3 C_2N Ethylenimine
 C_2O Ethylene oxide
 C_3 Cyclopropane
 Cyclopropene

4 CNO_2 Anisaldehyde, cyclohexylhydrazone peroxide*
 Benzaldehyde, cyclohexylhydrazone peroxide*

Benzaldehyde, *p* - dimethylamino-, cyclohexylhydrazone peroxide*
 C_2O_2 Toluene, α, α -methylenedioxy-*o* nitroso-(ν)
 C_4 Cyclobutane
5 CN_2S_2 Dithiodiazole
 CN_4 Tetrazole
 C_3N_2O Oxidiazole
 C_2N_2S Thiodiazole
 C_2N_3 Triazole

¹ All members of this class will be found together under "Spiro-" in the Subject Index.

- C₂O₂S Erythritol, disulfite
 Ethylene sulfite
 Mannitol, trisulfite
 Propylene sulfite, 3 chloro-
 C₄NO Isoxazole
 Oxazole
 C₂NS Thiazole
 C₃N₂ Imidazole
 Isoimidazole
 Pyrazole
 C₄O₂ Dioxole
 C₂S₂ Dithiole
 C₄N Isopyrrole
 Pyrrole
 C₄O Furan
 C₄S Thiophene
 C₅ Cyclopentadiene
 Cyclopentane
 Cyclopentene
6 C₅N₅ Pentazine
 C₂N₂O₂ Dioxdiazine
 C₂N₄ Tetrazine
 C₃NS₂ Hydropsendothiocyanic acid[†]
 C₃N₂O Oxidiazine
 C₃N₂S Isothiodiazine
 Thiodiazine
 C₃N₃ Triazine
 C₃O₂S Paraldehyde, monothio[†]
 Trimethylene sulfite
 C₄NO Oxazine
 C₄N₂ Pyrazine
 Pyridazine
 Pyrimidine
 C₄O₂ Dioxin
 C₄S₂ Dithiane
 C₄N Pyridine
 C₄O Pyran
 Pyrilium
 C₆S Thiopyrau
 C₆ Benzene
 Cyclohexane
 Cyclohexene
7 C₄N₂ Homopiperazine
 C₄O₂ Malonic acid, cyclic ethylene ester
 Oxalic acid, cyclic trimethylene ester
 C₆N Hexamethylenimine
 C₆O Hexamethylene oxide
 C₇ Cycloheptane
8 C₄N₂S 1,3,4 - Octathiodiazine, 5 - hydroxy
 8-keto-2-methylthiol-*
 C₆N₂ Bistrimethylenediimine
 C₆O₂ Succinic acid, cyclic ethylene ester
9 C₆O₂S Hexamethylene sulfite, tetrachloro
17 C₁₆O Ambrettolic acid, lactone
 Juniperic acid, lactone
 II
3, 5 CNO-C₂N₂O Furoxan
 C₂-C₄N 1,2-Cyclopropanedicarboximide, 1,2-dicyano-3-ethyl-3 methyl-
3, 6 C₃-C₆ Norcarane
3, 7 C₃O-C₇ Cycloheptane, 1,2 epoxy-
4, 4 C₄-C₄ Bicyclo[0.2.2]hexane
 Diquinoyl, *p*-dichloro-*
4, 5 C₂O₂ C₄N 3 - Pyrrolidone, 5 - *p* - anisyl - 2-methyl - 2 - (*N* - methylanilino)-, 4,5-peroxide
 3 - Pyrrolidone, 2 - methyl - 2 - (*N* - methylanilino) - 5 - phenyl-, 4,5-peroxide
 C₄-C₄O 1,2 - Cyclobutanedicarboxylic anhydride, 3,4-dimethyl-
4, 6 C₂N₂-C₂NS₂ Pseudothiocyangen*
 C₄-C₆ Norpinane
 Pinene
5, 5 C₄NO-C₄N 4 - Carboxy - 1,1 - dimethyl- 2 - methylenepyrrolidinium hydroxide, betaine
 Spiro[piperidine - 1,1' - pyrrolidine] - 3' - carboxylic acid, *N*-hydroxy-5'-methylene-, betaine
 C₄NS-C₄N₂ Imidazothiazole
 C₂N₂-C₂N₂ Glycoluril
 Isoimidazimidazole
 C₄O-C₄ 1,2 - Cyclopentanedicarboxylic anhydride, 2,3,3,4-tetramethyl-
 C₄-C₆ Bicyclo[1.2.2]heptene
5, 6 C₄AsO-C₆ Benzoic acid, *o* phenylarsino-, cyclic anhydride
 C₄HgO-C₆ Benzoic acid, *o*-(hydroxymercuro)-, anhydride
 C₂N₂S-C₆ Benzothiodiazole
 C₂N₂-C₄N Pyridotriazole
 C₂N₂-C₆ Benzotriazole
 C₂O₂S-C₆ *m*-Benzenedisulfonanilide, 4,5-dihydroxy-, sulfate
 m - Benzenedisulfonyl chloride, 4,5-dihydroxy-, sulfate
 Pyrocatechol, 1,2-sulfite
 C₃NO-C₆ Anthranil
 Benzisoxazole
 Benzoxazole
 C₄NS C₆ Benzisothiazole
 Benzothiazole
 C₄NSe-C₆ Benzoselenazole
 C₄N₂-C₄N₂ Pyrazopyridazine
 C₄N₂-C₄N Imidazopyridine
 C₄N₂-C₄S Thiopyranopyrazole
 C₃N₂-C₆ Benzimidazole
 Indazole
 Isoindazole
 C₄OS C₆ α,α' - Bi - *o* - toluenesulfonic acid, α-bromo - α' - hydroxy - 5,5' - dinitro-, α',2'-anhydride
 α,α' - Bi - *o* - toluenesulfonic acid, α,α' - dihydroxy - 5,5' - dinitro-, dianhydride
 2,2' - Stilbenedisulfonic acid, α-hydroxy - 4,4' - dinitro, α,2-anhydride
 C₄S₂-C₆ Benzodithiole
 Benzodithylium
 C₄N-C₄NO Morphopyrrolidine*
 C₄N-C₄N₂ Pyrrolopyrazine
 C₄N-C₄ Indole
 Isoindole
 Pseudoindole
 C₄O-C₄N Pyridisofuran
 C₄O-C₆ Benzofuran
 Benzofurorium
 Isobenzofuran
 C₄S-C₄N Pyridothiophene
 C₆-C₆N Cyclopentanecetic acid, 2-carboxy-, cyclic imide
 C₆-C₆O Camphoric anhydride
 C₆-C₆ Indene
5, 7 C₄N-C₄N Cardiazole*
6, 6 C₆NOS C₆ α,α' - Bi - *o* - toluenesulfonic acid, α,α' - dihydroxy - 5,5' - dinitro, dianhydride, pyridine deriv.
 2,2' - Stilbenedisulfonic acid, α-hydroxy - 4,4' - dinitro, α,2-anhydride, pyridine deriv.
 C₃N₂-C₆ Benzotriazine
 C₄NO-C₄N Morphopiperidine*
 C₄NO-C₆ Benzoxazine
 C₄N₂-C₄N Pyridopyrazine
 C₄N₂-C₆ Cinnoline
 Phthalazine

- Quinazoline
 Quinoxaline
 C₄O₂-C₈ Benzodioxan
 C₆S₂-C₈ Benzodithiin
 C₈N-C₈N Naphthyridine
 Pyrrolopyridine
 C₈N-C₈ Azabicyclo[3.3.1]nonane
 Azabicyclo[3.3.1]non-1-ene
 Isoquinoline
 Quinoline
 C₃O-C₈O Malonic acid, [α -(β , β -dihydroxy-*tert*-butyl)benzyl]methyl-, di-
 lactone
 C₈O-C₈ Benzopyran
 Benzopyrylium
 Cyclohexanone, α , α' - dicyclohexyl-,
 hydropyrone deriv.*
 C₈-C₈ Naphthalene
6, 7 C₈-C₈N₄ *o*-Phenylenethiocarbohydrazide*
 C₈-C₈N₂O 4,5 - Benzooct-1,2,6 - oxdiazine
 7-hydroxy.*
 C₈-C₈N₂ 2,3 - Benzo-1,4,7 - heptatriazine,
 5,6-diphenyl*
o-Phenylenesemioxamazide
 C₈-C₈NO Anthranilic acid, *N*- β -hydroxy-
 ethyl-*N*-methyl-, lactone
 C₈-C₈NS Benzoketohydro-1,5 - heptathi-
 azine-8-thiopropionic acid*
 C₈-C₈N Homotetrahydroisoquinoline*
6, 8 C₈-C₈H₈O₂S *o*-Cresol, 4,6 - bis(hydroxym-
 ercuri)-, cyclic sulfate
 C₈-C₈N₂O 4,5 - Benzooct-1,2,6 - oxdiazine, 7-
 hydroxy.*
 C₈-C₈N₂S 6,7 - Benzo-8 - keto-1,3,4 - octa-
 thiodiazine, 2 - methylthiol - 5-
 hydroxy.*
 C₈-C₈N₄ *o*-Phenylenesemimalonamide*
 C₈-C₇N Benzheptamethylenimine*
6, 11 C₈ C₈S₂ Phthalic acid, dithiol-, cyclic ester
 of 2,2'-thiobisethanol
 III
3, 5, 5 C₈-C₈-C₈ Apocyclene*
 Tricyclene*
3, 5, 6 N₈-C₂N₂-C₈ Triazirindiazene
4, 5, 5 C₈-C₈-C₈ Dicyclopentadiene*
5, 5, 6 C₈N₂-C₈N₂-C₈ Triazolobenzimidazole
 C₈N₂-C₈O-C₈ 2,1,3 - Benzotriazole - 4-
 glyoxylic acid, 5 - hydroxy-
 2-phenyl-, lactone
 C₈N₂-C₈-C₈ Indenotriazole
 C₈NS-C₈NS-C₈ Benzobisthiazole
 C₈NS-C₈N₂-C₈ Benzimidazothiazole
 C₈O₂-C₈O-C₈ Quinide, acetonebenzoyl.*
 C₈N-C₈N-C₈N₂ Dipyrrolopyrazine
 C₈O-C₈O-C₈ β - Cumidic acid, α , α' - di-
 chloro - α , α' - dihydroxy-,
 di- γ -lactone
 β - Cumidic acid, α , α , α' , α' -
 tetrachloro - α , α' - di-
 hydroxy-, di- γ -lactone
 Isophthalic acid, 4,6-bis(α -
 hydroxydimethylbenzyl) -
 (?), dilactone
 Pyromellitic anhydride
 Terephthalic acid, 2,5-bis(α -
 hydroxydimethylbenzyl) -
 (?), dilactone
5, 6, 6 C₈N₂O-C₈-C₈ Naphthoxazole
 C₈N₂-C₈N₂-C₈ Triazoloquinoxaline
 C₈N₂-C₈N-C₈ Triazoloquinoline
 C₈N₂-C₈-C₈ Isonaphthotriazole
 Naphthotriazole
 C₈NO-C₈NO₂-C₈ Anthranil, 1,2 - dihydro-
 1,2-methylenedioxy - (?)
 C₈NO-C₈-C₈ Naphthisoaxazole
 Naphthoxazole
 C₈NS-C₈-C₈ Naphthothiazole
 C₈N₂-C₈N₂-C₈ Imidazoquinoxaline
 Pyrazocinnoline
 C₈N₂-C₈N-C₈ Imidazoquinoline
 Pyrazoquinoline
 C₈N₂-C₈-C₈ Naphthimidazole
 C₈O₂-C₈N-C₈ Isoquinoline, 6,7 - methylene-
 dioxy-
 Quinoline, 5,6 - methylene-
 dioxy-
 C₈O₂-C₈O-C₈ Homopiperonylic acid, 6-(hy-
 droxymethyl)-, lactone
 C₈As-C₈-C₈ Dibenzarsenole
 C₈N-C₈N₂O-C₈ Oxidiazinoindole
 C₈N-C₈N₂-C₈ Triazinoindole
 C₈N-C₈N₂-C₈ Pyrroloquinoxaline
 C₈N-C₈N-C₈ Pyridindole
 Pyrroloquinoline
 C₈N-C₈O-C₈ 3 - Indolepropionic acid, 3-
 bromooctahydro - 3a-hy-
 droxy-2-keto-, δ -lactone
 C₈N-C₈ C₈ Carbazole
 Isocarbazole
 Naphthazole
 C₈O-C₈N-C₈ Furoquinoline
 C₈O-C₈O-C₈ 2 - Benzofuranpropionic acid,
 2 - bromooctahydro - 2a-
 hydroxy-1-keto-, lactone
 C₈O-C₈-C₈ Dibenzofuran
 Naphthofuran
 C₈-C₈N₂-C₈ Cyclopentaquinoxaline
 C₈-C₈-C₈ Acenaphthylene
 Fluorene
5, 6, 7 C₈-C₈ C₇ Homotetraphene*
6, 6, 6 C₈N₂-C₈N₂-C₈N₂ Hexamethylenetetramine
 C₈N₂-C₈-C₈ Isonaphthotriazine
 C₈AsN-C₈-C₈ Phenarsazine
 C₈AsO-C₈-C₈ Phenoxarsine
 C₈NO-C₈-C₈ Isophenoxazine
 C₈NS-C₈-C₈ Isophenothiazine
 Phenothiazine
 C₈N₂-C₈N₂-C₈N₂ Dipyrimidopyridazine
 C₈N₂-C₈N-C₈ Pyrimidoquinoline
 C₈N₂-C₈-C₈ Benzoquinoxaline
 Phenazine
 C₈O₂-C₈-C₈ Phenotelluroxonium
 Phenoxtellurine
 C₈N-C₈N-C₈ Phenanthroline
 C₈N-C₈O-C₈ Pyranoquinoline
 C₈N-C₈-C₈ Acridine
 Benzisoquinoline
 Benzoquinoline
 Phenanthridine
 C₈O-C₈O-C₈ Benzopyranopyran
 C₈O-C₈-C₈ Dibenzopyran
 Naphthopyran
 Naphthopyrylium
 Xanthene
 C₈S-C₈S-C₈ Benzodithiopyran
 C₈-C₈-C₈ Anthracene
 Benzonaphthene
 Phenanthrene
6, 6, 7 C₈N₂-C₈-C₈N₂ Compd. from alloxan and *o*-
 aminophenylhydrazine
 C₈S-C₈-C₈NS Thiochromanoneketohydro -
 10,6-heptazine*
 C₈-C₈-C₈N₂ 2,3 - Benzo-6,7 - methyl-
 benzo-1,4,5 - heptatriazine,
 4,5-dihydro.*
 2,3,6,7 - Dibenzo-1,4,5 -
 heptatriazine, 4,5-dihydro.*
 C₈-C₈-C₈O Diphenide

- C₆-C₈-C₇ Cycloheptanaphthene
6, 6, 8 C₆-C₈-C₄O₂S₂ *m*-Toluenesulfonic acid, 6-hydroxy-, bimol. cyclic sulfonylide
 C₈-C₈-C₈N₂O 2,3,7,8-Dibenzo-1,5,6-octatriazine*
 C₈-C₈-C₈N₂ 2,3,7,8-Dibenzo-1,5,6-octatriazine*
 C₈-C₈-C₈N₂ Phenitomazine
6, 6, 12 C₆-C₈-C₄O₂S₂ 1 - Phenol - 4 - sulfonic acid, bimol. cyclic sulfonylide
 IV
2, 4, 6, 6 C₂N-C₂N₂-C₂N₂-C₂N Pyridylmelanurenic acid*
5, 5, 6, 6 C₆N-C₆N₂-C₆N-C₆N Ditetrazolonaphthyridine
 C₈N₂-C₈-C₈-C₈ Fluorenimidazole
 C₈-C₈ C₆-C₈ Indenoindene
5, 6, 6, 6 C₂N₂S-C₄N₂-C₆-C₆ Thiadiazolophenazine
 C₂O₂S-C₆-C₆-C₆ Anthradiol, sulfite
 C₂N₂-C₄N₂-C₆ C₆ Pyrazophenazine
 C₄N-C₄N₂-C₆-C₆ Isoindoloquinazoline
 C₄N-C₆-C₆-C₆ Anthrapyrole
 Benzocarbazole
 C₄O-C₆N-C₆ C₆ Oxyquinoline
 C₄S-C₆-C₆ C₆ Anthrathiophene
 C₆-C₆N₂O C₆-C₆ Acenaphthoxdiazine
 C₆-C₆N₂ C₆-C₆ Acenaphthotriazine
 C₆-C₆N-C₆ C₆ Acenaphthopyridine
 Indenoquinoline
 C₈-C₈-C₆-C₆ Chrysfluorene
5, 5, 6, 7 C₂N-C₆-C₆-C₄N₂ Compd. from pseudoisatin and *o*-aminophenylhydrazone
5, 6, 6, 8 C₄N-C₆-C₆ C₄N₄ Isatin-*o*-phenylenedihydrazone¹
6, 5, 6, 6 C₂N₂O-C₆-C₆-C₆ Phenanthrothiazine
 C₂N₂-C₆ C₆-C₆ Phenantiazine
 C₄AsN-C₆-C₆ C₆ Benzophenarsazine
 C₄NO-C₆-C₆ C₆ Isobenzophenoxazine
 9 Phenanthrenecarboxylic acid, 8 amino-9,10-dihydro-10-hydroxy-, cyclic lactam
 C₄N₂-C₄N₂ C₆ C₆ Quinazoquinaxoline
 C₄N₂-C₄N-C₆ C₆ Quinoquinoxaline
 C₄N₂-C₆-C₆-C₆ Benzophenazine
 C₆N-C₆N-C₆ C₆ Dibenzocopyrine
 Dibenzoquinolizine
 C₆N-C₆O-C₆-C₆ Pyranobenzoquinoline
 C₆N-C₆ C₆-C₆ Benzacridine
 Naphthoquinoline
 C₆O-C₆-C₆ C₆ Benzoxanthylum
 C₆-C₆-C₆-C₆ Benzanthrene
 Chrysene
6, 6, 6, 7 C₆-C₆-C₆ C₂N₂S 3,4-Phenanthra-7-thiomethyl-1,2,5,6-heptathiotriazine*
 C₆-C₆ C₆ C₄N₂ 2,3-Benzo-6,7-naphtho-1,4,5-heptatriazine, 4,5 dihydro-*
 V
4, 5, 5, 6, 6 C₄-C₈ C₈-C₆-C₈ Truxene
5, 5, 5, 6, 6 C₂N₂S-C₂N₂S-C₄N-C₆-C₆ Acridine deriv., m. 216°
 C₂N₂-C₂N₂-C₂N-C₆-C₆ Ditrizoloacridine*
 C₂N₂-C₂N₂-C₄O-C₆-C₆ Xanthenobistriazole
 C₄N C₄N-C₆ C₆-C₆ Indolocarbazole
 C₄N-C₆-C₆ C₆-C₆ Acenaphthindole
 C₆-C₆-C₄O-C₆-C₆ Diindenopyran
5, 6, 6, 6, 6 C₄N-C₄N₂-C₆N-C₆-C₆ Evodiamine
 C₄N-C₄N₂-C₆-C₆-C₆ Naphthazoloquinoxaline
 C₄N-C₆-C₆-C₆-C₆ Naphthocarbazole
 C₆-C₄N₂ C₆-C₆-C₆ Acenaphthoquinoxaline
 C₆-C₆N-C₆-C₆-C₆ Acenaphthoquinoline
 C₆-C₆-C₆-C₆-C₆ Acenaphthanthracene*
 Dibenzofluorene
5, 6, 6, 6, 7 C₆-C₆-C₆-C₆-C₄N₂ 2,3-Benzo-5,6-acenaphtho-1,4,7-heptatriazine*
6, 6, 6, 6, 6 C₄NO-C₄NO-C₆-C₆-C₆ Triphenodioxazine
 C₄NO-C₄N₂-C₆-C₆-C₆ Isoquinoxalophenoxazine
 C₄NO-C₆-C₆-C₆-C₆ Isodibenzophenoxazine
 C₆N₂-C₆N-C₆-C₆-C₆ Dibenzopyridoquinoxaline
 C₄N₂-C₆-C₆-C₆-C₆ Dibenzophenazine
 C₆N-C₆-C₆-C₆-C₆ Dibenzacridine
 Naphthacridine
 C₆O-C₆-C₆-C₆-C₆ Dibenzoxanthene
 Dibenzoxanthylum
 C₆-C₆-C₆-C₆-C₆ Dibenzanthracene
 Perylene
6, 6, 6, 6, 7 C₆-C₆-C₆-C₆-C₄N₂ 2,3-Benzo-5,6-phenanthro-1,4,7-heptatriazine*
6, 4, 4, 6, 8 C₆-C₆-C₆-C₆-C₄N₄ Phenanthro-*o*-phenylenedihydrazone*

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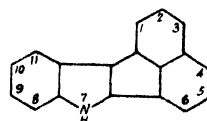
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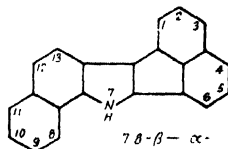
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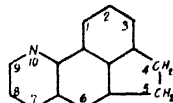
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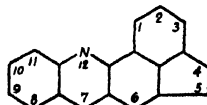
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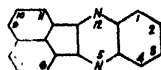


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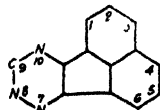
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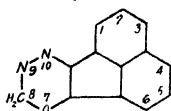
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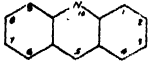
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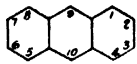
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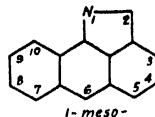
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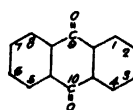
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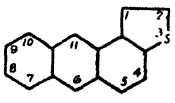
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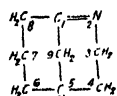
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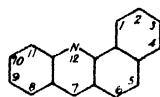
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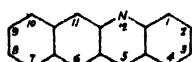
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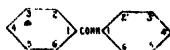
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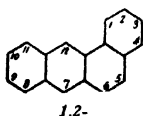
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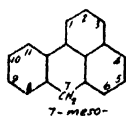
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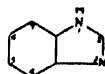
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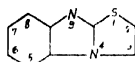


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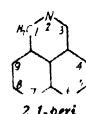
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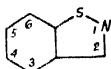
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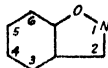
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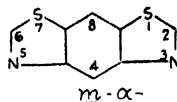


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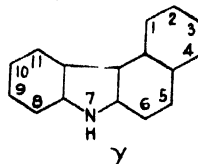
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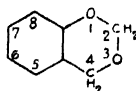


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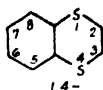


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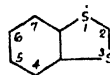


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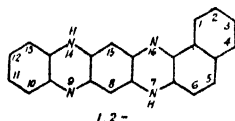
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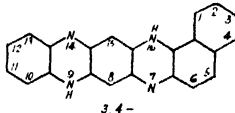
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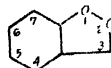
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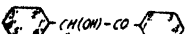
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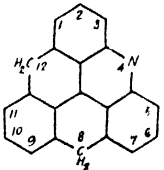
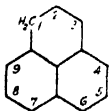
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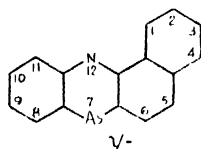
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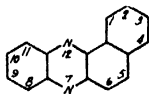
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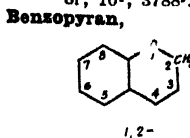


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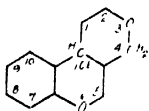
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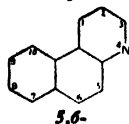
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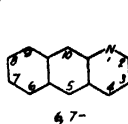


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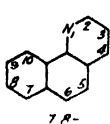
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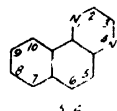
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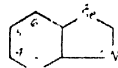
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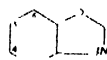
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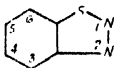
- Benzoquinoxalium compounds, 6-acet-amido-1,2,3-triphenyl-5,6— salts**, 1988¹.
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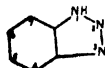


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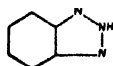
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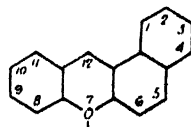
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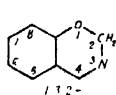
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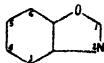
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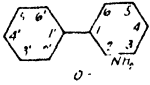
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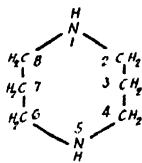
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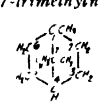
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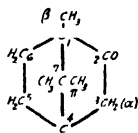
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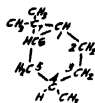
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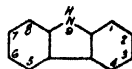
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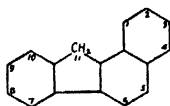
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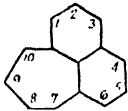
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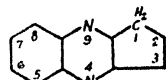
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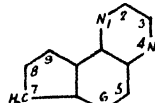
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[3,2- α]

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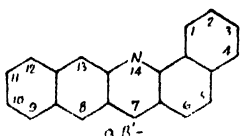
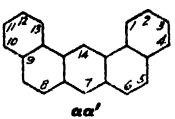
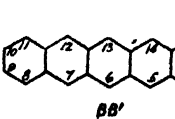
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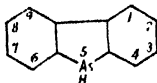
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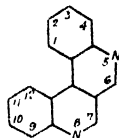
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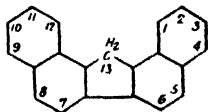


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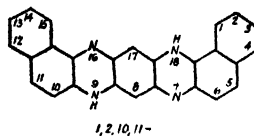
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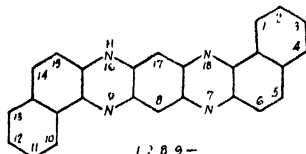


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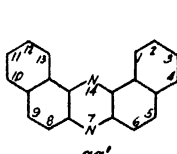
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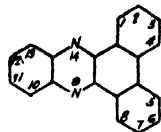
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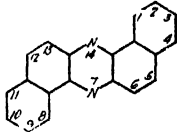
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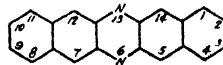
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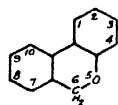
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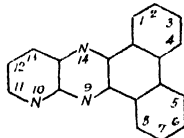
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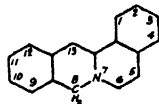
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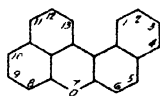
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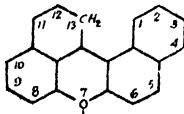


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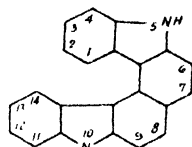
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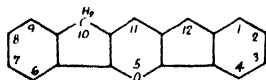
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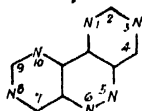
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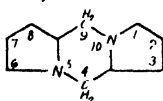
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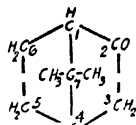
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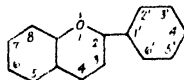
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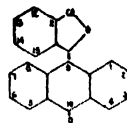
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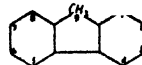
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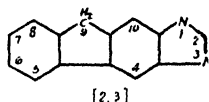
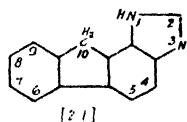
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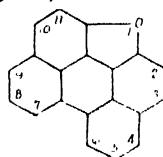
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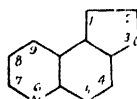
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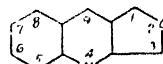
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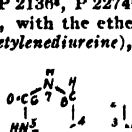
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$$\begin{array}{cccccccc} \text{NH} & \text{CH}_2 & \text{CH}_2 & \text{NH} & \text{CH}_2 & \text{CH}_2 & \text{CH}_2 & \text{CH}_2 \\ 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 \end{array}$$
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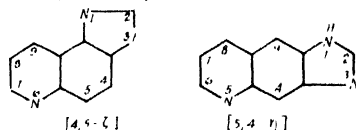
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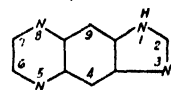
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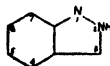
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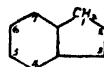
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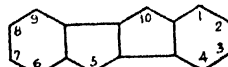
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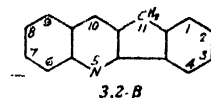
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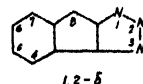
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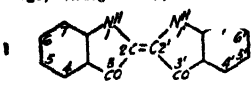
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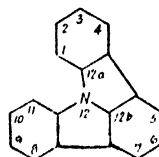
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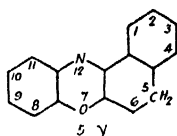
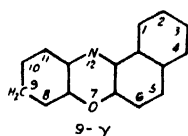
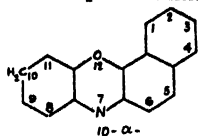
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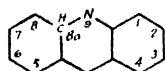
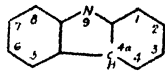
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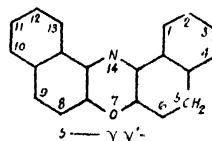
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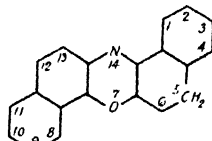
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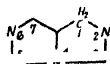
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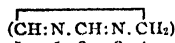
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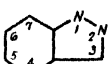
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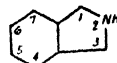
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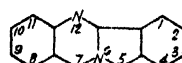
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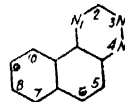
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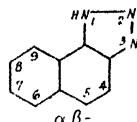
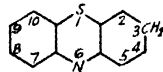
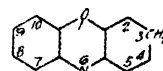
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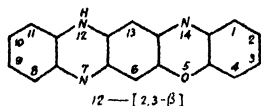
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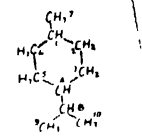
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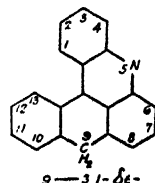
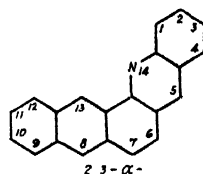
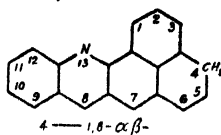
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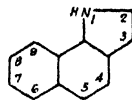
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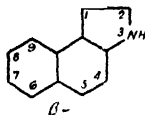
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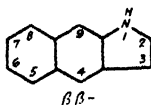
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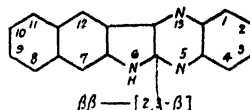
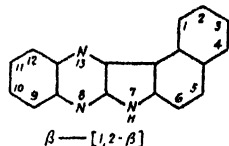
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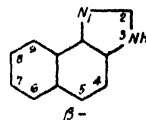
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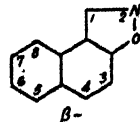
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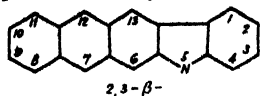
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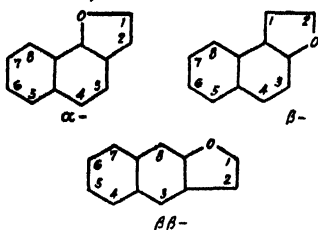
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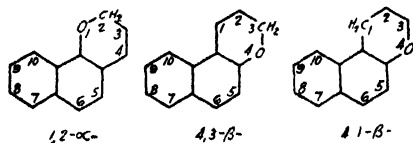
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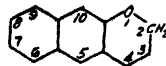
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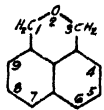
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4,3- β -

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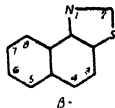


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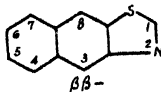


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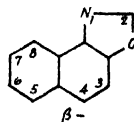
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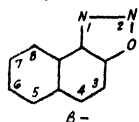
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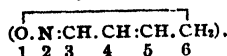
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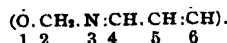
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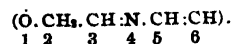


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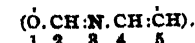
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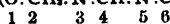
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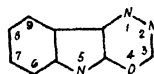


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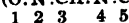
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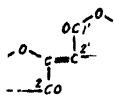
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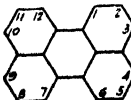
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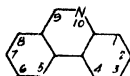
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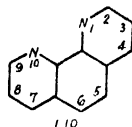
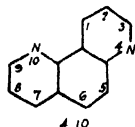
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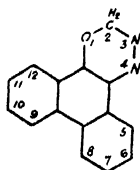
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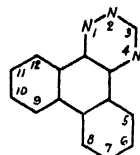


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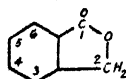
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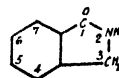
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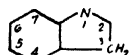
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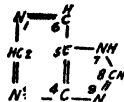
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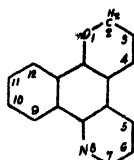
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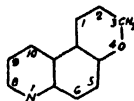
1,4-Pyran-2,6-dicarboxylic acid, 3-hydroxy-4-keto-. See *Meconic acid*.

—, **4-keto-**. See *Chelidonic acid*.

2,6(5)-Pyrandione. See *Glutaconic anhydride*, dihydro-. See *Glutaric anhydride*.

Pyranobenzoquinoline,

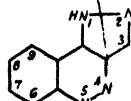
- 2-Pyranobenzoquinolone, 8-acetyl-5,6,7,8-tetrahydro-4,7-dimethyl-,** 411¹.
 —, **4,7-dimethyl-,** and salts, 411².
 —, **5,6,7,8-tetrahydro-4,7-dimethyl-,** and chloroplatinate, 411³.
 —, **5,6,7,8-tetrahydro-4,7-dimethyl-8-nitroso-,** 411³.
1,2-Pyran-2-ol, 4-*p*-anisyl-2,6-bis(2-hydroxy-*p*-anisyl)-, 410⁹.
 —, **6-*p*-anisyl-2-(2,4-cresyl)-4-phenyl-,** and acetate, 410⁸.
 —, **6-*p*-anisyl-2-(2-hydroxy-*p*-anisyl)-4-phenyl-,** 410⁸.
 —, **2-(2,4-cresyl)-4,6-diphenyl-,** and acetate, 410⁸.
 —, **6-(2,4-cresyl)-4-phenyl-6-salicyl-,** 410⁴.
 —, **4,6-di-*p*-anisyl-2-(2-hydroxy-*p*-anisyl)-,** 410⁷.

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- Pyraquinolinium compounds, 3-keto 7,8-dimethyl—iodide,** 411².
7,8,9,10-tetrahydro-3-keto-7,8-dimethyl—iodide, 411².
3-Pyraquinolone, 7-acetyl-7,8,9,10-tetrahydro-8-methyl-, 411⁷.
 —, **7-benzoyl-7,8,9,10-tetrahydro-8,10-dimethyl-,** 411³.
 —, **2-bromo-,** and salts, 382⁶.
 —, **2-bromo-8-methyl-,** and salts, 382⁷.
 —, **2-bromo-7,8,9,10-tetrahydro-,** and derivs., 382⁶.
 —, **2-bromo-7,8,9,10-tetrahydro-8-methyl-,** and salts, 382⁶.
 —, **2-bromo-7,8,9,10-tetrahydro-8-methyl-7-nitroso-,** 382⁶.
 —, **2-bromo-7,8,9,10-tetrahydro-7-nitroso-,** 382⁶.
 —, **8,10-dimethyl-,** and salts, 411³.
 —, **8-methyl-,** and derivs., 411³.
 —, **8-styryl-,** 411³.
 —, **7,8,9,10-tetrahydro-8,10-dimethyl-,** 411³.
 —, **7,8,9,10-tetrahydro-8,10-dimethyl-7-nitroso-,** 411³.
 —, **7,8,9,10-tetrahydro-8-methyl-,** and salts, 411³.
 —, **7,8,9,10-tetrahydro-8-methyl-7-nitroso-,** 411³.

Pyranthin, effect on body temp., 1678⁹.**1,2-Pyran-2,3,6-trione, 4-chloro- \dagger , 3-phenylhydrazone,** 3615⁷.**Pyrgaryite,** elec. conduction in, 1748².**Pyrazine (1,4-diazine; paradiazine; piazine),**

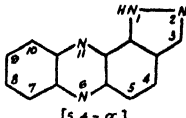
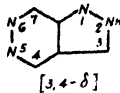
- , **diacetyldihydro-2,5-dimethyl-3,6-bis(*o*-nitrophenyl)-,** 75⁸.
 —, **dibenzoyldihydro-3,5-dimethyl-3,6-bis(*o*-nitrophenyl)-,** 75⁸.
 —, **2,5-dihydro-3,6-dimethyl-2,5-bis(*o*-nitrophenyl)-,** 75⁸.
 —, **dihydrodiphenyl-,** addn. compds. with SnCl₄, 3902².
 —, **hexahydro-,** See *Piperazine*.
 —, **tetraphenyl-,** addn. compds. with SnCl₄, 3902².
2(1)-Pyrazinone, 3,6-bis[*m* (and *p*)-nitrophenyl]-, 1984⁹.

Pyrazocinnoline,{4,5- γ }

- 1-Pyrazo[4,5- γ]cinnolinecarboxylic acid, 2,3,3a,4,5,9b-hexahydro-3-keto-,** Me ester, 1124¹.

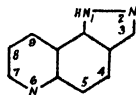
Pyrazole (1,2-diazole), (NH.N:CH.CH₂CH₂—)

- , **1-acetyl-4-chloro-3(or 5)-methyl-,** 2899¹.
 —, **1-acetyl-3(or 5)-[2,3(and 2,5)-cresyl]-5(or 3)-methyl-,** acetate, 2471³, 2472².
 —, **1-allyl-3(and 5)-methyl-,** and picrate, 2899².
 —, **1-(*p*-aminophenyl)-5-phenyl-,** 1450⁶.
 —, **1-benzoyl-4-chloro-3(or 5)-methyl-,** 2899¹.
 —, **1-benzyl-4-chloro-3(and 5)-methyl-,** and salts, 2899¹.
 —, **1,3-bis(*p*-nitrophenyl)-,** 1450⁷.
 —, **3(or 5)-chloro-4,5(or 3,4)-dimethyl-,** and picrate, 2898⁹.
 —, **4-chloro-1,3(1,5 and 2,5)-dimethyl-,** and salts, 2898⁹.
 —, **4-chloro-3(or 5)-methyl-,** and picrate, 2898⁹.
 —, **4-chloro-3(or 5)-methyl-1-(*o*-nitrobenzoyl)-,** 2899¹.
 —, **3(and 5)-chloro-1,4,5(and 1,3,4)-trimethyl-,** and picrates, 2898⁹.
 —, **4-chloro-1,3,5-trimethyl- and picrate,** 2898⁹.
 —, **3(or 5)-[2,3(or 2,5)-cresyl]-5(or 3)-methyl-,** and derivs., 2471³, 2472².
 —, **5-[2,3(or 2,5)-cresyl]-3-methyl-1-phenyl- \dagger ,** 2472².
 —, **1-(2,5-dibromo-4-hydroxy-3,6-dimethylbenzyl)-3,5-dimethyl- \dagger ,** 903⁷.
 —, **1-(2,5-dibromo-4-hydroxy-3,6-dimethylbenzyl)-2,5-diphenyl- \dagger ,** 903⁷.
 —, **1-(2,5-dibromo-4-hydroxy-3,6-dimethylbenzyl)-3(and 5)-methyl- \dagger ,** 903⁷.
 —, **1-(2,5-dibromo-4-hydroxy-3,6-dimethylbenzyl)-3(and 5)-methyl-5(and 3)-phenyl- \dagger ,** 903⁷.

- , **dihydro-**. See *Pyrazoline*.
 —, **dihydroketo-**. See *Pyrazolone*.
 —, **1,3-(and 1,5)-dimethyl-4-nitro-**, 2899^a.
 —, **1,4-diphenyl-**, 2259^a.
 —, **3(or 5)-(2-hydroxy-1-naphthyl)-5(or 3)-methyl-**, 2472^a.
 —, **1-(*p*-nitrophenyl)-3-(and 5)-phenyl-**, 1450^a.
1-Pyrazolecarboxamide, **5-(2,5-cresyl)-3-methyl-**, 2471⁷.
4-Pyrazolecarboxanilide, **3(or 5)-methyl-1,5-(or 1,3)-diphenyl-**, 734^a.
 —, **3(or 5)-methyl-1-phenyl-5(or 3)-styryl-**, 734^a.
1-Pyrazolecarboxylic acid, **5-(3-methylsali-cyl)-3-methyl-**, lactone, 2471⁷.
3-Pyrazolecarboxylic acid, **1-allyl-5-methyl-**, and ethyl ester, 2899^a.
5-Pyrazolecarboxylic acid, **1-allyl-3-methyl-**, and ethyl ester, 2899^a.
 —, **4-amino-**, 3904^a.
 —, **3-benzyl-4-hydroxy-**, and ethyl ester, tautomerism of, 3903^a.
 —, **1-(4-cyano-3-nitrophenyl)-3-(phen-ethyl)-**, ethyl ester, 2901^a.
 —, **1-(4-cyano-2-nitrophenyl)-3-styryl-**, ethyl ester, 2901^a.
 —, **4-hydroxy-3-isoamyl-**, and ethyl ester, tautomerism of, 3903^a.
 —, **4-hydroxy-3-phenyl-**, ethyl ester, tautomerism of, 3904^a.
 —, **3-styryl-**, ethyl ester, 2901^a.
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 —, **4-hydroxy-**, derivs., tautomerism of, 3903^a.
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 —, **1-allyl-4,4-diethyl-2-phenyl-**, therapeutic action of, 1329^a.
 —, **1,2-dibenzyl-4,4-diethyl-**, therapeutic action of, 1329^a.
4,5-Pyrazolodione, **1,3-diphenyl-**, 4-oxime, 1099^a.
 —, **3-phenyl-**, 4-oxime, 1099^a.
 —, **1(and 3)-phenyl-3(and 1)-*p*-tolyl-**, 4-oxime, 1100^a.
 —, **3-*p*-tolyl-**, 4-oxime, 1100^a.
Pyrazole series, isomerism in, 2898^a.
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 —, tautomerism of 4-hydroxy derivs., 3903^a.
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 —, **keto-**. See *Pyrazolone*.
Δ¹-Pyrazoline, **2,3-dimethyl-1-phenyl-5-phenylimino-**. See *Anilopyrine*.
Δ²-1-Pyrazolinecarboxamide, **4-bromo-5-keto-3-methylthio-**, 2128^a.
 —, **4,4-dibromo-5-keto-3-methyl-**, 2128^a.
 —, **4,4-dibromo-5-keto-3-methylthio-**, 2128^a.
 —, **4,5-diketo-3-methyl-**, 4-oxime, 2128^a.
 —, **4,5-diketo-3-methylthio-**, 4-oxime, 2128^a.
 —, **4(and 5)-keto-3-methyl-**, and -HCl, 2128^a.
 —, **5-keto-3-methyl-4-phenylazo-**, 2128^a.
 —, **5-keto-3-methyl-4-phenylazo-**, 2128^a.
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 —, **2-benzyl-4-chloro-1,3-(and 1,5)-dimethyl-** iodide, 2898^a, 2899^a.
 —, **2-benzyl-5-chloro-1,3,4-trimethyl-** iodide, 2898^a.
 —, **4(and 5)-chloro-1,2,3,5-(and 1,2,3,4)-tetramethyl-** iodide, 2898^a.
 —, **4-chloro-1,2,3-trimethyl-** iodide, and picrate, 2898^a.
 —, **1,2,3-trimethyl-4-nitro-** iodide, 2899^a.
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3-Pyrazolone, **4-dimethylamino-1,5-dimethyl-2-phenyl-**. See *Pyramidone*.
 —, **1,5-dimethyl-2-phenyl-**. See *Antipyrene*.
5-Pyrazolone, **4-benzyl-1-phenyl-**, 906^a.
 —, **1-(6-chloro-3-pyridyl)-3-methyl-(?)**, 1814⁷.
 —, **4,4'-methenylbis[3-methyl-1-phenyl-**, 3362^a.
 —, **4-methyl-**, 2898^a.
 —, **3-(3,4-methylenedioxyphenyl)-1-phenyl-**, 2456⁷.
 —, **3-methyl-4-nitro-1-(*p*-nitrophenyl)-**. See *Picrolonic acid*.
 —, **3-methyl-1-phenyl-4-(1,2,3,4-tetrahydro-2,3-dimethyl-6,7-methylenedioxy-1-isoquinolyl)-**, 1990^a.
 —, **3-methyl-1-phenyl-4-(1,2,3,4-tetrahydro-8-methoxy-2-methyl-6,7-methylenedioxy-1-isoquinolyl)-**, and -HCl, 1990^a.
 —, **1-(*p*-nitrophenyl)-3-phenyl-**, 1450^a.
 —, **1,3,4-trimethyl-**, and picrate, 2898^a.
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 [5,4-α]
5(4)-Pyrazo[5,4-α]phenazinone, **4,4-dichloro-**, 2893⁷.
Pyrazopyridazine,

 [3,4-δ]

3(8)-Pyrazo[3,4-*b*]pyridazinone, 4-hydroxy-2,6-diphenyl-, and sodium deriv., 1973^{1,4}.

Pyrazoquinoline,



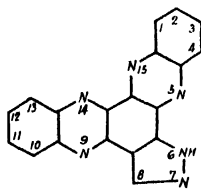
[5,4-*b*]

[4,5-*η*]

Pyrazo[4,5-*η*]quinoline, 9-chloro-, and -HCl, 2693³.

Pyrazo[5,4-*b*]quinoline, and methiodide, 2693³.

Pyrazo[4,5-*α*]quinoxalo[2,3-*γ*]phenazine,



[4,5-*α*] — [2,3-*γ*]

2693³.

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Pyrex. See *Glass*.

Pyridazine (1,2-diazine; orthodiazine),

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—, **1,2-bis[(carboxymethyl)carbonyl]-1,3,5,6-tetrahydro-4-methyl-, diethyl ester, 1123⁹.**

—, **4,5-dibromo-1,2-bis[(carboxymethyl)carbonyl]hexahydro-4-methyl-, diethyl ester, 1123⁹.**

—, **1,2,3,6-tetrahydro-3,6-diphenyl-, 1124².**

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1,2-Pyridazinedicarboxylic acid, 4,5-dibromo-3,4,5,6-tetrahydro-3,6-diphenyl-, dimethyl ester, 1124².

—, **3,6-dihydro-3,6-diphenyl-, dimethyl ester, 1124².**

—, **3,6-dihydro-4-Δ¹-isohexenyl-, dimethyl ester, 1123⁹.**

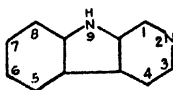
—, **3,6-dihydro-4-methyl-, diethyl ester, 1123⁹.**

4,5-Pyridazinedicarboxylic acid, 4,5-dihydro-3,6-dimethyl-, diethyl ester, calorific value of, 202⁶.

3,6-Pyridazinedione, 1,2,4,5-tetrahydro-1,2-diphenyl-, therapeutic action of, 1329¹.

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2,9-Pyridindole,



2,9-

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—, **3,4-dihydro-7-methoxy-1-methyl-, See *Harmaline*.**

—, **3,4-dihydro-1-methyl-, 1270¹.**

—, **7-methoxy-1-methyl-. See *Harmine*.**

—, **1,2,3,4-tetrahydro-, and picrate, 3622⁸.**

—, **1,2,3,4-tetrahydro-1-keto-, 1263¹.**

—, **1,2,3,4-tetrahydro-2-*o*-nitrobenzoyl-, 3622⁸.**

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cementation of iron and steel with vapors of, 1622⁹.

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on amyolysis by diastase, 2321⁹.

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—, **2-amino-, condensation with aliphatic aldehydes, 94⁸.**

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—, **3-amino-, P 3370⁴.**

—, **2-amino-5-arsinoso-, 2902².**

—, **2(and 4)-(p-aminobenzoyl)-†, and salts, 94^{1,2,3}.**

- , **2**(and **4**)-(*p*-aminobenzyl)-, and salts, 941^{1,2}.
- , **2-amino-5-iodo**-, P 414⁶, P 415⁴.
- , **2**(**3** and **4**)-(*p*-aminophenyl)-, and salts, 585^{2,3,4}.
- , **6-*p*-anisyl-2-bromo-3,4-diphenyl**-, 1651⁶.
- , **2-*p*-anisyl-6-(2,4-cresyl)-4-phenyl**-, 410⁸.
- , **2**(and **4**)-*p*-anisyl-6-(and 2)-(2-hydroxy-*p*-anisyl)-4-(and 6)-phenyl-, 410^{8,9}.
- , **3,3'-arsenobis[6-amino-]**, 2902³.
- , **3,3'-arsenobis[6-bromo-]**, 2902³.
- , **3,3'-arsenobis[6-chloro-]**, 2902³.
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- , **5-arsinoso-2-chloro-**, 2902³.
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- , **5-arsyl-2-bromo-**, 2902³.
- , **5-arsyl-2-chloro-**, 2902³.
- , **5-arsyl-2-iodo-**, 2902³.
- , **2,3-azimino***, 1986⁶.
- , **aziminochloro***, 1986⁶.
- , **2,2'-azobis-**, and salts, 1814⁸.
- , **2**(and **3**)-benzalamino-, 1814⁹.
- , **2,2'-(benzaldilimino)bis-**, 1814⁹.
- , **2**(and **5**)-bromo-5-(and 2)-iodo-, 3620¹.
- , **5-butyryl-2-propyl-**†, and oxime, 2130^{4,5}.
- , **5-carbamido-2-ethoxy-**†, 1814⁵.
- , **5-carbamido-2-methoxy-**†, 1814⁵.
- , **2-chloro-5-hydrazino-**, 1814⁵.
- , **2-(2,4-cresyl)-4,6-diphenyl-**, 410⁴.
- , **2-(2,4-cresyl)-4-phenyl-6-salicyl-**, and picrate, 410⁵.
- , **2,5-diacetamido-**, 1986⁶.
- , **2,3**(and **2,5**)-diamino-, and salts, 1986^{2,4}.
- , **2,3-diamino-4(or 6)-chloro-**, 1986³.
- , **2,3-diamino-5-chloro-**, 1986³.
- , **2,3-diamino-4,5(or 5,6)-dichloro-**, 1986³.
- , **2,4-di-*p*-anisyl-6-(2-hydroxy-*p*-anisyl)-**, 410⁸.
- , **3,5-dibromo-2-iodo-**, 3620¹.
- , **dihydroketo-**. See *Pyridone*.
- , **1,2-dihydro-1-methyl-2-methyl-imino-**, methiodide, 247¹.
- , **1,2-dihydro-1-phenacyl-2-phenacyl-imino-**, and chloroplatinate, 246⁸.
- , **2,5-diiodo-**, 3620¹.
- , **dimethyl-**. See *Lutidine*.
- , **2-dimethylamino-**, and methiodide, 247¹.
- , **2-ethoxy-5-nitro-**, 1814⁵.
- , **2-ethyl-5-propionyl-**†, and derivs., 386⁵, 387¹.
- , **hexahydro-**. See *Piperidine*.
- , **3-hydrazino-**, and derivs., P 3370⁴.
- , **2-hydrazino-5-nitro-**, P 594¹, P 2906³, P 3900².
- , **2**(**3** and **4**)-(*p*-hydrazinophenyl)-, and salts, 585^{2,3,4}.
- , **2,2'-hydrazobis-**, 1814⁸.
- , **2,2'-iminobis[bromo-(?)]**, and di-HBr, 3619⁹.
- , **2,2'-iminobis[nitro-(?)]**, 3619⁹.
- , **iodo-**, compds., P 1332².
- , **3-iodo-**, P 3370⁴.
- , **2-isobutenyl-5-β-methylcrotonyl-**†, and derivs., 2130⁴.
- , **3,3'-mercuribis[6-acetamido-(?)]**, 1814⁸.
- , **2-methoxy-5-nitro-**, 1814⁵.
- , **methyl-**. See *Picoline*.
- , **3-(α-methylenebenzyl)-**, 909⁴.
- , **2-(1-methyl-2-pyrryl)-**. See *α-Nicotryne*.
- , **2-(5-methyl-2-pyrryl)-**, and picrate, 406⁹.
- , **2**(and **4**)-*p*-nitrobenzoyl-†, and derivs., 93⁹, 94^{2,4}.
- , **2-(*p*-nitrobenzyl)-**, salts, 93⁸.
- , **2**(**3** and **4**)-(*p*-nitrophenyl)-, and salts, 585^{1,3,4}.
- , **2**(and **4**)-[*o*(and *m*)-nitrophenyl]-, and salts, 585^{2,4,5}.
- , **2-*p*-phenetyl-**, and picrate, 585².
- , **2**(**3** and **4**)-phenyl-, nitration of, 585¹.
- , **2-(2-pyrrolidyl)-**, and salts, 3905^{4,5}.
- , **2-[1(2 and 3)-pyrryl]-**, 3362^{2,3}.
- , **2-[2(and 3)-pyrryl]-**, 406^{8,9}.
- , **3-(tetrahydro-1-methyl-2-pyrryl)-**. See *Nicotine*.
- , **2,4,6-trimethyl-**. See *s-Collidine*.
- , **2,4,6-triphenyl-**. *N*-oxide, and salts, 94⁹.
- 3-Pyridinearsonic acid, 6-amino-**, 2902³. and salts, 1986⁶.
- , **6-bromo-**, 2902³.
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- , **6-chloro-**, 1814⁷, 2902³.
- , **5-chloro-6-hydroxy-**, 2902³.
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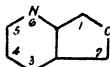
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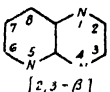
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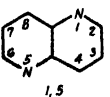
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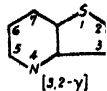
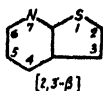
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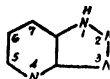
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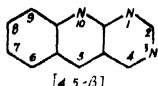
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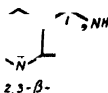
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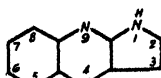
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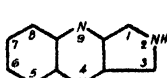


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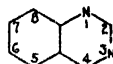
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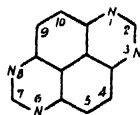
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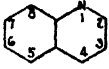
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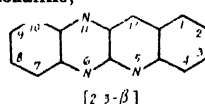
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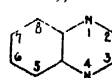
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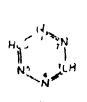
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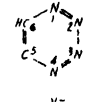
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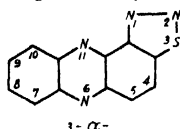
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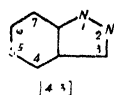
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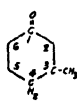
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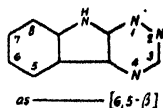
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1 2 3 4 5 6
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1 2 3 4 5 6
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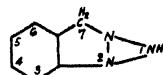
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(NH.N:N.CH:CH)

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1,2,4-Triazole (*pyrro[ab]diazole*),

(NH.N:CH.N:CH)

1 2 3 4 5

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—, 1-(benzamidophenyl)-3,5-diethyl-, and salts, 3200².

—, 1-(benzamidophenyl)-3,5-dimethyl-, 3200².

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1,2,5-Triazole (*pyrro[aa]diazole*),

(NH.N:CH.CH:N)

1 2 3 4 5

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(NH.CH:N.N:CH)

1 2 3 4 5

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—, 2-anilino - 5 - (benzylmercapto)-1-phenyl-, 2900².

—, 2-anilino - 5 - (methylmercapto)-1-phenyl-, 2900².

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1,2,5 - Triazole - 3 - carboxylic acid, 4-benzoyl-1-phenyl-, 2268².

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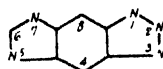
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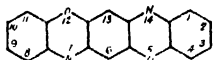
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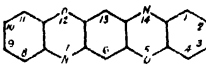
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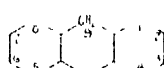
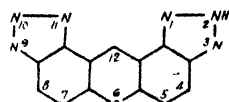
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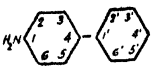
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III. FORMULA INDEX

KEY.

In using this index the following should be borne in mind:

1. The Formula Index is **supplementary** to the Subject Index; in no sense does it replace any part of the latter except that most of the organic compounds that were not named in the original papers are entered in the former only.

2. **Inorganic as well as organic compounds** have been entered.

3. **Entries under their own formulas** are made for all strictly inorganic and strictly organic compounds and for the true organic derivatives of organic compounds, both addition compounds and true reaction derivatives (this includes esters, hydrazones, methohalides, oximes, picrates, semicarbazones, etc.). Inorganic salts of organic acids and inorganic addition compounds of organic compounds (hydrohalides, chloroplatinates, perchlorates, sulfates, etc.) are not given separate entries but are indicated in modifying phrases under the formulas of the compounds from which they are derived (under the acid in the case of a salt). Salts of formic, acetic and oxalic acids are exceptions; these are entered as such.

4. The **arrangement of symbols in formulas** is alphabetical except that in carbon compounds C always comes first, followed immediately by H if hydrogen is also present.

5. The **arrangement of formulas** is also alphabetical except that the number of atoms of any specific kind influences the order of compounds. *E. g.*, all formulas with 1 C come before those with C₂, thus: CCl₂O, CCl₄, CHCl₃, CHN, CHNO, CH₂Br₂, CH₂O, CH₃Cl, CO, C₂Ca, C₂H₄O₂.

6. The **arrangement of entries under any heading** is strictly alphabetical according to the preferred names of the isomers.

7. **Entries consist of** (a) the formula (in bold-face type), (b) the name as it has been entered in the Subject Index (in light-face Roman type; *it should be noted particularly that the part of the entry in this type is the exact equivalent of the formula given*), (c) occasionally a modifying phrase or word such as "Ca salt" or "hydrochloride" (in italics, different type being used to set off that part of a compound being indexed which is not represented in the formula used; see ¶ 3 above), (d) the page reference and (e) the fraction of the page in ninths (indicated by a small superior numeral) in which the compound will be found.

8. **Cross-references** are to the Subject Index.

9. **Water of hydration** is not made a part of the formulas indexed but is usually given in light-face type following the formulas.

10. **Polymers** having different names and recognized as different substances, *e. g.*, acetaldehyde and paraldehyde, are all entered under their accepted formulas. But definite compounds for which different polymeric formulas are in use are entered under the simplest formula only with cross-references under the polymeric formulas.

11. **A straight line**, thus —, used under some headings to avoid repetition of names, always stands for the name of the "index compound," *i. e.*, that part of the preceding name (inverted) which comes before the comma.

12. "P" before a page number indicates that the abstract is of a **patent**.

13. The names **beryllium** (Be), **columbium** (Cb) and **hafnium** (Hf) are given preference over glucinum (Gl), niobium (Nb) and celtium (Ct), respectively, for these elements.

The Key to a formula index is necessarily lengthy. It would not be correct to conclude from this that this index is difficult to use. Experience is to the contrary.

INTRODUCTION.

General purpose and policy. The location of chemical compounds in an index by names is at times uncertain because names vary and in the case of complex compounds may be difficult to ascertain. New compounds are constantly being prepared, which, if named at all, may receive more than one name which is justified from one point of view or another and the possibilities of incorrect names are great. Since the kinds and number of component atoms of a chemical compound are unvarying characteristics the supplementary Formula Index to *Chemical Abstracts* is published for the purpose of eliminating this element of uncertainty in the Subject Index. Except that many unnamed compounds are no longer entered under the heading "Compound," the Subject Index is in no way altered on account of the Formula Index. In the Subject Index related compounds are *grouped* rather effectively and to good use by the present system of indexing on the basis of "parent compounds" or more accurately "index compounds"; in the Formula Index the certain location of *individual* compounds is the primary consideration. The Subject Index is more convenient to use in some respects and it frequently contains more information in the form of modifying phrases. The repetition of modifying phrases in the Formula Index beyond necessary brief phrases to indicate derivatives has been avoided as unnecessary for the accomplishment of the real purpose of this index, as stated above, and as inconsistent with necessary economy. Isomerism is not indicated in the Formula Index in cases in which the names differ only in position numbers or letters but it always is in the Subject Index when known. Ready reference to the Subject Index for the purpose of locating information regarding related compounds is made possible by the use in the Formula Index of names following the formulas written exactly as they appear in the former index.

All new compounds and all compounds for which new data are given have been entered. Most of the compounds have been entered under their own formulas. Some departure from a policy of making separate formula entries for derivatives of all kinds is reasonable and accords with custom. The only departures in this index (see ¶ 3

of the Key) have been in classes of compounds the natures of which would be more than likely apparent to the investigator. The interest in a salt of a complex organic acid, for example, is likely to be mainly in the acid and it is considered more valuable to have the record of it under the formula of the acid for the use of searchers looking up that acid.

In the case of unnamed organic compounds where possible the class, as acid, source and melting or boiling point have been given.

* Cross-references to the Subject Index have been used for all simple inorganic compounds, for all minerals of definite composition and for the organic compounds more commonly met with, in general whenever it seemed likely that users of *Chemical Abstracts* would predominatingly refer to the Subject Index.

The system. The system, as described in the Key, is, with slight modifications, that worked out by Dr. Edwin A. Hill, and used by the Classification Division of the U. S. Patent Office. This system is preferred to the system of Richter's *Lexikon* because of its greater simplicity and its applicability with equal fitness to inorganic as well as to organic compounds.

- AgBF₃H₂O**, 1235⁴.
AgBF₃H₂N₂, 1235⁴.
AgBF₃H + 5H₂O Silver fluoborate, 2230⁴.
AgBr See *Silver bromide*.
AgCl See *Silver chloride*.
AgClH₂N₃, 3571².
AgClO₃ See *Silver chlorate*.
AgClO₄ See *Silver perchlorate*.
AgHO See *Silver hydroxide*.
AgI See *Silver iodide*.
AgMg, 855².
AgNO₃ See *Silver nitrate*.
AgN₂O₅TI Silver thallium nitrate, 1781⁴.
Ag₂S₂Sb See *Miargyrite*.
Ag₂B₂O₃, 1771⁴.
Ag₂Cl₂Tl Silver thallium chloride, 842⁷.
Ag₂CrO₄ See *Silver chromate*.
Ag₂Cr₂O₇ See *Silver dichromate*.
Ag₂F₂Ge Silver fluorgermanate, 3171⁴.
Ag₂GeO₃ Silver metagermanate, 1068².
Ag₂O See *Silver oxides*.
Ag₂O₂ See *Silver oxides*.
Ag₂O₃ See *Silver oxides*.
Ag₂O₄S See *Silver sulfate*.
Ag₂S See *Silver sulfide*.
Ag₂Te See *Hessite*.
Ag₂As₂S₂ See *Proustite*.
Ag₂Cl₂H₂N₂O₂Rh, 868⁴.
Ag₂S₂Sb See *Pyrargyrite*.
Ag₂Sb See *Silver antimonide*.
AlBr₃ See *Aluminum bromide*.
AlCl₃ See *Aluminum chloride*.
AlCl₃H₂O₆, 2229⁴.
AlCl₃Li Aluminum lithium chloride, 3572⁴.
AlCl₃NO, 3573⁴.
AlFLiO₂P See *Amblygonite*.
AlF₃Na₃ See *Cryolite*.
AlHO₂ See *Diaspore*.
AlHO₂Si₂ See *Pyrophyllite*.
AlH₂O₂ See *Aluminum hydroxide*.
AlH₂NO₂S₂ + 12H₂O See *Ammonium alum*.
Al₂O₂S₂ + 12H₂O See *Alums*.
Al₂O₃Si₂ See *Adularia*.
Al₂LiO₂Si₂ See *Spodumene*.
AlN See *Aluminum nitride*.
AlN₂O₃ See *Aluminum nitrate*.
AlNaO₃ See *Sodium aluminate*.
AlNaO₂Si₂ See *Albite*.
Al₂B₂H₂O₁₁Si₂ + 4H₂O See *Harmotome*.
Al₂Be₂O₁₁Si₂ See *Aquamarine*; *Beryl*.
Al₂CaH₂O₁₁Si₂ + 3H₂O See *Heulandite*.
Al₂CaO₄ Calcium aluminate, 1528⁴.
Al₂CaO₂Si₂ See *Anorthite*.
Al₂CaO₂Si₂ + 7H₂O See *Silbite*.
Al₂Ca₂H₂O₁₁Si₂ See *Prehnite*.
Al₂Ca₂Mn₂O₁₁Si₂ See *Tinzenite*.
Al₂Ca₂O₂ Calcium aluminate, 2971².
Al₂Ca₂O₂Si₂, 999², 2229⁴.
Al₂Cl₂K₂ Potassium phosgenoaluminate, 3572⁴.
Al₂Cl₂Li₂ Lithium phosgenoaluminate, 3572⁴.
Al₂Cl₂Mg Magnesium phosgenoaluminate, 3572⁴.
Al₂Cl₂Pb Lead phosgenoaluminate, 3572⁴.
Al₂Cu, 3338².
Al₂FHLiO₁₀Si₂ See *Lepidolite*.
Al₂H₂O₂Si₂ See *Nacrite*.
Al₂H₂O₂Si₂ See *Kaolin*.
Al₂Mg₄, 3338⁴.
Al₂MnO₂Si₂, 2244².
Al₂Mn₂O₂Si₂, 2244².
Al₂O₂ See *Alumina*; *Bauxite*; *Boehmite*; *Corundum*; *Diaspore*; *Hydrargillite*.
Al₂O₂Pb Lead aluminate, 181⁴.
Al₂O₂Si₂ See *Andalusite*; *Cyanite*; *Sillimanite*.
Al₂O₁₂Si₂ See *Aluminum sulfate*.
Al₂Zn₂, 47⁴.
Al₂Ca, 1953², 2652⁴.
Al₂Ca₂HO₂₁Si₂ + H₂O See *Tesuvianite*.
Al₂ClNa₂Si₂O₁₂ See *Sodalite*.
Al₂H₂EO₁₄Si₂ See *Alunite*.
Al₂Mg₃, 3339².
Al₂Mn, 1955², 3337⁴, 3339⁴.
Al₂Na₂O₁₁Si₂ See *Noselite*.
Al₂Ca₂H₂O₁₁Si₂ See *Pollucite*.
Al₂Mn, 3337⁴.
Al₂O₁₂Si₂ + 5H₂O See *Köchite*.
Al₂Cl₂Mg₂ Aluminum magnesium chloride, 3572⁴.
Al₂Ca₂O₁₄ Calcium aluminate, 2971².
Al₂F₂H₂O₁₁Si₂ See *Zunzite*.
Al₂O₁₁Si₂ See *Mullite*.
Al₂O₂Si₂ + 8H₂O See *Anauxite*.
Al₂Ca₂O₁₁ Calcium aluminate, 1528⁴.
AsBr₃ See *Arsenic bromide*.
AsCl₃ See *Arsenic chloride*.
AsCoS See *Cobaltite*.
AsCr See *Chromium arsenide*.
AsCuS See *Lawtite*.
AsFe See *Iron arsenide*.
AsFeO₄ See *Iron arsenates*.
AsFeS See *Arsenopyrite*.

- AsH₂O₄Pb** See *Schultenite*.
AsH₃ See *Arsine*.
AsH₃Mo₂O₇ + 4H₂O, 2442ⁿ.
AsH₃O₃ See *Arsenious acid*.
AsH₃O₄ See *Arsenic acid*.
AsI₃ See *Arsenic iodide*.
AsNa₃O₃ See *Sodium arsenite*.
AsNa₃O₄ See *Sodium arsenate*.
AsNi See *Nickel arsenide*.
AsSb₂ Antimony arsenide, 3011⁴.
As₂O₅O₃ See *Calcium arsenate*.
As₂O₃ See *Safforite*.
Al₂O₃·8Zn See *Miedskiankite*.
As₂O₃·8 See *Tennantite*.
As₂Te See *Lodlingite*.
As₂Fe₂O₃, 3528⁹.
As₂Mn₂O₃·5H₂O See *Schallerite*.
As₂Ni See *Rammelsbergite*.
As₂O₃ See *Arsenic oxides*.
As₂O₄ See *Arsenic oxides*.
As₂Pt See *Sperryite*.
As₂S₃ See *Arsenic sulfides*; *Orpiment*.
As₂Fe₂O₃ + 8H₂O, 3528⁹.
AuBr₃·K Potassium bromoaurate, 2761⁴.
AuCl See *Gold chlorides*.
AuCl₃ See *Gold chlorides*.
AuCl₃H See *Chloroauric acid*.
AuCl₃·K Potassium chloroaurate, 2761⁴.
AuCl₃·Na Sodium chloroaurate, 2761⁴.
AuNa₃O₃·S See *Sanocrysin*.
AuSn, 3552⁹.
AuZn, 855⁴, 2655¹.
Au₂O₃ See *Gold oxides*.
Au₂Te₂ See *Gold telluride*.
Au₂Zn, 2654⁹.
Au₂Cl₃H₂N₆, 3496¹.

BCl₃ See *Boron chloride*.
BCoH₂N₃, 1420⁹.
BCaF₃ See *Avogadrite*.
BF₃H See *Fluoboric acid*.
BF₃H₂N₂ Hydrazine fluoborate, 2230⁴.
BF₃·K See *Potassium fluoborate*.
BF₃·NO Nitrosylborofluoride, 1235⁴.
BF₃·Na See *Sodium fluoborate*.
BF₃·Tl Thallium fluoborate, 1235⁴.
BF₃·Zn + 6H₂O Zinc fluoborate, 214⁶.
BF₃·H₂SO₄ + H₂O Acid mercurous fluoborate, 214⁶.
BEH₂NaO₄ + 3H₂O, 2854⁹.
BEH₂O₃ See *Boric acid*.
BN See *Boron nitride*.
BNaO₃ See *Sodium perborate*.
BO See *Boron oxides*.
B₂BaF₆ + 2H₂O Barium fluoborate, 214⁶.
B₂BO₃, 1771⁹.
B₂CaF₆ Calcium fluoborate, 214⁶, 1235⁴.
B₂CdF₆·H₂N₄, 1235⁴.
B₂Cl₂H₂N₄, 541⁴.
B₂CoF₆ + 6H₂O Cobaltous fluoborate, 214⁶.
B₂CoF₆·H₂N₄, 1235⁴.
B₂CuF₆ + 6H₂O Copper fluoborate, 2230⁴.
B₂CuF₆·H₂N₄, 868⁴.
B₂CuF₆·H₂N₄ + 0.5H₂O, 868⁴.
B₂F₂·Fe + 6H₂O Ferrous fluoborate, 214⁶.
B₂F₂·H₂O·Sr, 1235⁴.
B₂F₂·H₂·MgO, 1235⁴.
B₂F₂·H₂·MnO, 1235⁴.
B₂F₂·H₂·Zn, 1235⁴.
B₂F₂·H₂·MnN₃, 1235⁴.
B₂F₂·H₂·N₂, 1235⁴.
B₂F₂·Mg + 7H₂O Magnesium fluoborate, 214⁶.
B₂F₂·Mn + 6H₂O Manganese fluoborate, 2230⁴.
B₂F₂·Ni + 6H₂O Nickel fluoborate, 214⁶.

B₂F₂·Sr + 4H₂O Strontium fluoborate, 214⁶.
B₂F₂·Tl + H₂O Thallium fluoborate, 2230⁴.
B₂F₂·Pb₂ + 5H₂O Lead fluoborate, 2230⁴.
B₂H₂ See *Boron hydrides*.
B₂H₄ See *Boron hydrides*.
B₂H₄I₂, 541⁴.
B₂H₄ See *Boron hydrides*.
B₂H₄N₂, 541⁴.
B₂N₂ See *Boron nitride*.
B₂O₂·Zn, 1771⁹.
B₂O₂·Zn₂, 1771⁹.
B₂S₂ See *Boron sulfide*.
B₂Cl₂·H₂N₄, 541⁴.
B₂Cl₂·H₂N₄O₂, 541⁴.
B₂CoF₆·H₂N₄, 1235⁴.
B₂CrF₆·H₂N₄, 1235⁴.
B₂H₂N₂, 541⁴.
B₂H₂N₂O₂, 541⁴.
B₂BO₃, 1771⁹.
B₂CdF₆ + 6H₂O Cadmium fluoborate, 214⁶.
B₂H₂ See *Boron hydrides*.
B₂MnO₇ Manganese borate, 1333⁹.
B₂Na₂O₇ See *Borax*.
B₂O₂·Zn Zinc borate, 1333⁹.
B₂H₂ See *Boron hydrides*.
B₂H₂N₄, 541⁴.
B₂BO₃, 1771⁹.
B₂Ca₂O₁₁ + 5H₂O See *Colemanite*.
B₂BO₃, 1771⁹.
BaBr₂ See *Barium bromide*.
BaCl₂ See *Barium chloride*.
BaCl₂O₃ See *Barium perchlorate*.
BaCrO₄ See *Barium chromate*.
BaF₂ See *Barium fluoride*.
BaF₂·Si See *Barium fluosilicate*.
BaGeO₃ + 3H₂O Barium metagermanate, 1068¹.
BaH₂ See *Barium hydride*.
BaH₂O₂ See *Barium hydroxide*.
BaH₂S₂ See *Barium hydrosulfide*.
BaI₂ See *Barium iodide*.
BaMo₂O₁₁ + 9H₂O Barium tetramolybdate, 3171³.
BaNO₂O₃ See *Barium nitrate*.
BaO See *Barium oxides*.
BaO₂ See *Barium oxides*.
BaO₂S See *Barite*; *Barium sulfate*.
BaO₂·Se Barium selenate, 3290⁴.
BaS See *Barium sulfide*.
BaTe Barium telluride, 1922⁹.
BeBr₂·Sn + 10H₂O Beryllium hexabromostannate, 3168⁹.
BeCl₃ See *Beryllium chloride*.
BeCl₂·H₂N₄ Addn. compd. of BeCl₂ and hydrazine, 1601⁹.
BeCl₂·Li₂ Beryllium lithium chloride, 1216⁹.
BeCl₂·Na₂ Beryllium sodium chloride, 1216⁹.
BeCl₂·Tl₂ Beryllium thallium chloride, 1216⁹.
BeF₂·Na Beryllium sodium fluoride, 707⁶.
BeF₂·Li₂ Beryllium lithium fluoride, 1426⁴.
BeI₂ See *Beryllium iodide*.
BeO See *Beryllium oxide*.
BeS See *Beryllium sulfide*.
BeSe See *Beryllium selenide*.
BeTe See *Beryllium telluride*.
Be₂Cl₂·Tl Beryllium thallium chloride, 1216⁹.
Be₂FeO₁₀·Si₂·Y₂ See *Gadolinite*.
Be₂O₂·Si See *Phenacite*.
BiCl₃ See *Bismuth chloride*.
BiCl₃·NO, 3573⁹.
BiH₂O₃ See *Bismuth hydroxide*.
BiI₃ See *Bismuth iodide*.
BiNaO₃ See *Sodium bismuthate*.
Bi₂O₃ See *Bismuth oxide*.

Bi₂Te₃ Bismuth telluride, 1781⁷, 2655⁴.
BrCl See *Bromine chloride*.
BrClOS Thionyl chlorobromide, 544¹.
BrClSn Tin chlorobromide, 3571⁴.
BrCl₂HgK, 3570⁴.
BrCoH₁₁N₃O₂S₂, 2442⁴.
BrCs See *Cesium bromide*.
BrCu See *Copper bromides*.
BrH See *Hydrobromic acid*.
BrHMgS See *Magnesium bromide hydrosulfide*.
BrHMgSe See *Magnesium bromide hydroselenide*.
BrH₂N See *Ammonium bromide*.
BrHg See *Mercury bromides*.
BrI See *Iodine bromide*.
BrISn Tin bromiodide, 3571⁴.
BrK See *Potassium bromide*.
BrK₂O See *Potassium bromate*.
BrLi See *Lithium bromide*.
BrMg See *Magnesium subbromide*.
BrNa See *Sodium bromide*.
BrNaO See *Sodium hypobromite*.
BrNa₂O See *Sodium bromate*.
BrNb See *Rubidium bromide*.
BrTl See *Thallium bromide*.
Br₂Ca See *Calcium bromide*.
Br₂Cd See *Cadmium bromide*.
Br₂Cl₂HgK₂, 3570⁴.
Br₂Cl₂K₂Pt Potassium dibromo-tetrachloro-platinate, 3289⁷.
Br₂CoH₁₁N₃O₂, 3298³.
Br₂Cu See *Copper bromides*.
Br₂Cu₂ See *Copper bromides*.
Br₂H₂N₂O₂Pt + 2H₂O, 2620⁹.
Br₂Hg See *Mercury bromides*.
Br₂Mg See *Magnesium bromide*.
Br₂OS Thionyl bromide, 544¹.
Br₂O₂Pb Lead bromate, 3270⁷, 3324⁷.
Br₂Ru See *Ruthenium bromide*.
Br₂S See *Sulfur bromide*.
Br₂Sn See *Tin bromides*.
Br₂Sr See *Strontium bromide*.
Br₂Cr See *Chromium bromide*.
Br₂ErO₂ Erbium bromate, 870⁴.
Br₂GdO₂ See *Gadolinium bromate*.
Br₂HoO₂ Holmium bromate, 870⁴.
Br₂LaO₂ See *Lanthanum bromate*.
Br₂NdO₂ See *Neodymium bromate*.
Br₂OP See *Phosphorus oxybromide*.
Br₂O₂Pr See *Praseodymium bromate*.
Br₂O₂Sm + 9H₂O See *Samarium bromate*.
Br₂O₂Tb See *Terbium bromate*.
Br₂O₂Yt Yttrium bromate, 870⁴.
Br₂P See *Phosphorus bromides*.
Br₂Sb See *Antimony bromide*.
Br₂Ge See *Germanium bromide*.
Br₂K₂Pt Potassium bromoplatinite, 3280⁹.
Br₂Si See *Silicon tetrabromide*.
Br₂Sn See *Tin bromides*.
Br₂Tl See *Thallium bromide*.
Br₂H₂N₂O₂Pt, 2620⁹.
Br₂KPh₂ Lead potassium bromide, 1602⁷.
Br₂P See *Phosphorus bromides*.
Br₂C₂H₂Sn + 10H₂O Cesium hexabromostannate, 3168³.
Br₂H₂N₂Sn Ammonium bromostannate, 3170⁴.
Br₂K₂Pt Potassium bromoplatinate, 3280⁹.
Br₂Er₂Sn Rubidium hexabromostannate, 3168³, 3571⁴.
Br₂P Addn. compd. of PBr₃ and Br, 3301⁴.
Br₂T₂P Addn. compd. of PBr₃ and Br, 3301⁴.

CAg₂O₂ See *Silver carbonate*.

CBaO₂ See *Barium carbonate*.

CB₂N See *Cyanogen bromide*.

CB₂N₂O₂ Methane, dibromodinitro-, 52⁴.

CB₂NO₂ Bromopiricin, 52⁴.

CB₂ See *Carbon tetrabromide*.

CCa₂N₂ See *Calcium cyanamide*.

CCaO₂ See *Calcite*; *Calcium carbonate*; *Hydrocalcite*; *Whiting*.

CCdO₂ See *Cadmium carbonate*.

CCIN See *Cyanogen chloride*.

CCINS Thiocyanogen chloride, 898⁷, 1449⁴.

CCl₂O See *Phosgene*.

CCl₂O₂Tl₂, 1418⁴.

CCl₂S See *Thiophosgene*.

CCl₂NO₂ See *Chloropiricin*.

CCl₂ See *Carbon tetrachloride*.

CCl₂O₂S Methanesulfonyl chloride, trichloro-, 1626⁴, 3042⁹.

CCl₂S Methanesulfonyl chloride, trichloro-, 2659⁴.

CCuN See *Copper cyanide*.

CF₄ See *Carbon tetrafluoride*.

CFeO₂ See *Iron carbonate*.

CF₂ See *Cementite*.

CHBrCH₃ Methane, bromochloroiodo-, 1444⁷.

CHBrCl₂ Methane, bromodichloro-, 1039³.

CHBr₂NO₂ Methane, dibromonitro-, 52⁴.

CHBr₂ See *Bromoform*.

CHCl₂ See *Chloroform*.

CHI₃ See *Iodoform*.

CHKO₂ See *Potassium carbonates*.

CHN See *Hydrocyanic acid*.

CHNO See *Cyanoic acid*; *Fulminic acid*.

CHNS See *Thiocyanic acid*.

CHN₂Na Cyanamide, Na deriv., 898⁷.

CHN₂S₂ Formic acid, dithiotriazo-, *NH₂* salt, 3226⁴; salts, 1940⁴.

CHNaO₂ See *Sodium formate*.

CHNaO₂ See *Sodium carbonates*.

CHO₂Tl Thallium formate, 1781⁴.

CH₂BrClO₂S Methanesulfonic acid, bromochloro-, and salts, 2872^{1,2}.

CH₂BrIO₂S Methanesulfonic acid, bromoiodo-, and Ba salt, 2872^{1,2}.

CH₂Br₂ See *Methane, dibromo-*.

CH₂LMg₂ Methylenebismagnesium dibromide, 563⁹.

CH₂ClIO₂S Methanesulfonic acid, chloroiodo-, and salts, 2872^{1,2}.

CH₂Cl₂O Methane, chloronitroso-, 1107³.

CH₂Cl₂ See *Methane, dichloro*; *Solästhin*.

CH₂Cl₂O₂S Methanesulfonic acid, dichloro-, and salts, 2871^{1,2}.

CH₂Cu₂O₂ (See also *Malachite*.) 657².

CH₂I₂ See *Methane, diiodo-*.

CH₂LMg₂ Methylenebismagnesium diiodide, 563⁹.

CH₂I₂O₂S Methanesulfonic acid, diiodo-, and salts, 2871^{1,2}, 2872¹.

CH₂N₂ See *Cyanamide*; *Methane, diazo-*.

CH₂N₂O Carbamyl azide, 570³.

CH₂O See *Formaldehyde*.

CH₂O₂ See *Formic acid*.

CH₂O₂ See *Carbonic acid*.

CH₂S₂, 3301⁴.

CH₂Br See *Methane, bromo-*.

CH₂Cl See *Methane, chloro-*.

CH₂ClHg Methylmercuric chloride, 3600¹.

CH₂ClO₂S Methyl chlorosulfonate, 1626⁴.

CH₂Cl₂NO₂Tl₂, 1418⁴.

CH₂HgI Methylmercuric iodide, 3600¹.

CHI₂ See *Methane, iodo-*.

CH₂NO See *Formamide*.

CH₂NO₂ Methane, nitro-, 736⁴, 1645⁴.

CH₂N₂O₂ Urea, nitro-, 61⁴.

CH₂NaO See *Sodium methoxide*.

- CH₃NaO₃S** Sodium formaldehydesulfoxylate, 545⁹.
CH₃O₃V Methyl pervanadate, 545⁹.
CH₄ See *Methane*.
CH₃HgO Methylmercuric hydroxide, 3600¹.
CH₃N₃O See *Ammonium cyanate*; *Urea*.
CH₃N₃O Urea, hydroxy-, 570².
CH₃N₃S See *Ammonium thiocyanate*; *Urea, thio-*.
CH₃N₃O₂ Guanidine, α -nitro-, 1968⁴, 3890².
CH₃O See *Methanol*.
CH₃O₃S Methanesulfinic acid, hydroxy-, and salts, 3171².
CH₃O₃S Methanesulfonic acid, hydroxy-, K salt, 223⁴.
CH₃S Methyl mercaptan, 2340⁶, 3127⁹.
CH₃NO₂ See *Ammonium carbonates*.
CH₃NO₃S Sulfamic acid, methyl-, Ba salt, 65¹.
CH₃N₃ See *Guanidine*.
CH₃N₃O Semicarbazide, 2128³.
CH₃N₃S Semicarbazide, thio-, 2128³, 2901³.
CH₃N₃ Tetrazole, NH₄ deriv., 3054⁹.
CH₃Cl₄FeN Methylammonium tetrachloro-
rate, 711⁴.
CH₃N₂ Hydrazine, methyl-, 736⁶.
CH₃N₂O₂ Ammonium carbamate, 3304⁴.
CH₃N₃ Guanidine, α -amino-, 3201¹.
CH₃N₂O Carbohydrazide, 2693⁹.
CH₃N₃O₂ See *Ammonium carbonates*.
CH₃S₈, 3301⁸.
Cl₃S₂Sn, 3571⁴.
CKN See *Potassium cyanide*.
CKNS See *Potassium thiocyanate*.
CK₂O₃ See *Potassium carbonates*.
CLi₂O₂ See *Lithium carbonate*.
CMgO₂ See *Magnesite*; *Magnesium carbonate*.
CMnO₃ See *Manganese carbonate*.
CNNa See *Sodium cyanide*.
CNNa₃ See *Sodium thiocyanate*.
CN₂OS Nitrosyl thiocyanate, 891⁴.
CN₂O₃ Methane, tetranitro-, P 2478⁹, 2658³, 3887¹.
CN₂O₂ See *Sodium carbonates*.
CNiO₂ See *Nickel carbonate*.
CNi₂ Nickel carbide, 1236¹.
CO See *Carbon monoxide*.
CO₂ See *Carbon dioxide*.
CO₂Pb See *Lead carbonate*.
CO₂Br See *Strontianite*; *Strontium carbonate*.
CO₂Tl₂ See *Thallium carbonate*.
CO₂Zn See *Zinc carbonate*.
CS₂ See *Carbon disulfide*.
CSi See *Silicon carbide*.
CTi See *Titanium carbide*.
CV See *Vanadium carbide*.
CW See *Tungsten carbides*.
CW₂ See *Tungsten carbides*.
CZr See *Zirconium carbide*.
C₂AgKN₃ Potassium silver cyanide, 1401².
C₂Ag₂O₃ See *Silver oxalate*.
C₂AsBr₂Cl₃N Addn. compd. of BrCN and AsCl₃, 3170⁴.
C₂AsBr₂N Addn. compd. of BrCN and AsBr₃, 3170⁴.
C₂Br₂O₄ See *Barium oxalate*.
C₂Br₂Cl₃N₃Br Addn. compd. of BrCN and SbCl₃, 3170⁴.
C₂Br₂Cl₃N₃Tl₃ Addn. compd. of BrCN and TlCl₃, 3170⁴.
C₂Br₂N₃Sn Addn. compd. of BrCN and SnBr₄, 3170⁴.
C₂Br₂O₃S Compd., m. 134°, from egg albumin, 3892⁹.
C₂O₃ See *Calcium carbide*.
C₂O₂N₂ See *Calcium cyanide*.
C₂CaO₂ See *Calcium oxalate*.
C₂OdO See *Cadmium oxalate*.
C₂Cl₂O₂ Oxalyl chloride, 1645⁶.
C₂Cl₂O₂Pb₂, 3527⁹.
C₂Cl₄ See *Ethylene, tetrachloro-*.
C₂CoO₂ See *Cobalt oxalate*.
C₂Cr₂Fe₂, 2642⁹.
C₂CuN₂S₂ Copper thiocyanate, 1599⁴.
C₂FeO₂ See *Iron oxalates*.
C₂HBr Acetylene, bromo-, 2118¹.
C₂HBr₂O See *Bromal*.
C₂HCl₃ See *Ethylene, trichloro-*.
C₂HCl₃O See *Chloral*.
C₂HCl₃O₂ See *Acetic acid, trichloro-*.
C₂HCl₅ See *Ethane, pentachloro-*.
C₂HN₂O 1,3,4-Triazole, 2,5-epoxy-, 2900⁶.
C₂HNa See *Sodium acetylides*.
C₂H₂ See *Acetylene*.
C₂H₂AgN₃ 1,2,4-Triazole, Ag deriv., and NH₄ deriv., 3054⁹.
C₂H₂BrClO₂ Acetic acid, bromochloro-, 232².
C₂H₂Br₂ Ethane, tetrabromo-, 1781⁴.
C₂H₂CaN₃ Tetrazole, Ca deriv., 3054⁹.
C₂H₂ClO₂ Acetic acid, chloriodo-, and NH₄ salt, 1963⁹.
C₂H₂Cl₂ See *Ethylene, dichloro-*.
C₂H₂Cl₂O Acetyl chloride, chloro-, 2884².
C₂H₂Cl₂O₂ See *Acetic acid, dichloro-*.
C₂H₂Cl₂ See *Ethane, tetrachloro-*.
C₂H₂CuN₃ 1,2,4-Triazole, Cu deriv., and NH₄ compd., 3054⁹.
C₂H₂KO₂PSr + 2H₂O, 3322⁷.
C₂H₂N₂OS₂ 1,2,4-Oxadiazole-3,5(2,4)-dione, 3,5-dithio-(?), 2120⁷.
C₂H₂N₂S₂ 1,3,4-Thiadiazole-2,5-dimercaptan, 2128⁹.
C₂H₂NNa 1,2,4-Triazole, Na deriv., 3054⁹.
C₂H₂O Ketene, P 3626⁴.
C₂H₂O₂ Glyoxal, 1060², 2662⁷, 2877⁴.
C₂H₂O₂Br₂ Oxalic acid, dithiol-, salts, 1094⁹.
C₂H₂O₂ See *Glyoxylic acid*.
C₂H₂O₂ See *Oxalic acid*.
C₂H₂S₂ Oxalic acid, tetrathio-, 3609⁹.
C₂H₂AgO₂ See *Silver acetate*.
C₂H₂BiO₂ See *Bismuth acetates*.
C₂H₂Br Ethylene, bromo-, 2117⁹, 2248².
C₂H₂BrO Acetaldehyde, bromo-, 3888².
C₂H₂Cl Ethylene, chloro-, P 3369¹.
C₂H₂ClO See *Acetyl chloride*.
C₂H₂ClO₂ See *Acetic acid, chloro-*.
C₂H₂ClO₂S Acetic acid, sulfo-, di-K salt, 1729⁶.
C₂H₂Cl₃ Ethane, 1-trichloro-, 14⁹.
C₂H₂Cl₃O Ethanol, 2-trichloro-, 387⁹.
C₂H₂Cl₃O₂ See *Chloral hydrate*.
C₂H₂KO₂ See *Potassium acetate*.
C₂H₂LiO₂ Lithium acetate, 1919⁶.
C₂H₂N See *Acetonitrile*.
C₂H₂NO Acetaldehyde, imino-, 3888².
Glyconitrile, 388⁹.
Isocyanic acid, Me ester, 1632⁹, 2132².
C₂H₂NO₂ Acetic acid, nitro-, 1580⁷, 2591⁹.
C₂H₂NaO₂ See *Sodium acetate*.
C₂H₂O₁₃Se₂V₂ Vanadic acetoselenates, 712⁴.
C₂H₂ See *Ethylene*.
C₂H₂BrClO₂S Ethanesulfonyl chloride, 2-bromo-, 2663².
C₂H₂Br₂ See *Ethane, dibromo-*.
C₂H₂Br₂O Ethanol, 1,2-dibromo-, 732⁶.
C₂H₂ClNO Acetamide, α -chloro-, 2255⁷, 3889⁹.
C₂H₂Cl₃ See *Ethane, dichloro-*, 14⁹.
C₂H₂Cl₃O₂S Ethanesulfonyl chloride, α -chloro-, 2872².

- $C_2H_5HgN_2O_4$ Mercury deriv. of guanidine, cyano-, 2444².
 C_2H_5I See *Ethane, diiodo*.
 $C_2H_5N_2OS$ 1, 2, 3, 4, 3 - Dithiodiazole, 5 - (methylmercapto)-, 2-oxide, 3199⁴.
 $C_2H_5N_2O$ Glyoxime, 58³.
 $C_2H_5N_2O_2$ Glyoxyloxyhydroxamic acid, oxime, and salts, 1097³, 1098¹.
 $C_2H_5N_2O_4$ Oxalohydroxamic acid, and salts, 1097³, 1098¹.
 $C_2H_5N_2O_5$ Ethylene nitrate, 177², 2385¹.
 $C_2H_5N_2PdS_4$, 3168¹.
 $C_2H_5N_2$ See *Guanidine, cyano*.
 $C_2H_5Na_2O_2$ Glycol, disodium deriv., P 2906⁴.
 C_2H_5O See also *Acetaldehyde; Vinyl alcohol*.
 Ethylene oxide, 2467³, 3889⁴.
 $C_2H_5O_2$ Acetic acid, thiol, 847⁷.
 $C_2H_5O_3$ See also *Acetic acid; Formic acid, methyl ester*.
 Glycolaldehyde, 3888³.
 $C_2H_5O_3S$ Acetic acid, mercapto-, P 987⁷.
 $C_2H_5O_4S$ (See also *Glycolic acid*).
 Methyl carbonate, 2413³, 3520⁴.
 Peracetic acid, 2466⁴, 2877⁹.
 $C_2H_5O_5S$ Ethylene sulfite, 1796³.
 $C_2H_5O_6$ See *Glyoxylic acid*.
 $C_2H_5O_7S$ Acetic acid, sulfo-, P 1272⁷.
 C_2H_5S Acetaldehyde, thio-, 2872⁴.
 $C_2H_5S_2$ Acetic acid, dithio-, 3609⁴.
 $C_2H_5AsO_3$ Acetic acid, arsono-, 905³.
 C_2H_5Br See *Ethane, bromo*.
 C_2H_5Cl See *Ethane, chloro*.
 C_2H_5ClO Ethanol, 2-chloro-, 1137⁴, 1970⁴, 2418², 3046⁷, 3889⁹.
 Ethyl hypochlorite, 3051⁴.
 $C_2H_5ClO_3S$ Chlorosulfonic acid, Et ester, 2659⁴.
 C_2H_5I See *Ethane, iodo*.
 C_2H_5NO (See also *Acetamide*).
 Acetaldehyde, amino-, 3888³.
 Acetaldehyde, oxime, 75³, 8⁴.
 Formamide, N-methyl-, P 2273⁴.
 Formimidic acid, Me ester, -HCl, 387⁹.
 C_2H_5NOS Ethyl mercaptan, S-nitroso-, 890⁷.
 $C_2H_5NO_2$ (See also *Glycine*).
 Ethane, nitro-, 736⁴, 1645⁴, 2414¹.
 $C_2H_5NO_2$ Ethyl nitrate, 1981⁹.
 $C_2H_5N_2O_2$ Biuret, 866³.
 C_2H_5NaO See *Sodium ethoxide*.
 $C_2H_5NaO_2$ Glycol, sodium deriv., P 2906⁴.
 $C_2H_5Na_2O_5S_2$, 3171².
 C_2H_5 See *Ethane*.
 $C_2H_5Al_3CaNa_3O_8Si_3$ See *Cancrinite*.
 $C_2H_5CaN_4$, 713³.
 $C_2H_5KMnO_4$, 540².
 $C_2H_5KO_3P$ Ethyl potassium phosphate, 423⁴.
 C_2H_5N Azomethane, 1742³, 2590⁹, 3526¹.
 $C_2H_5N_2O_2$ Urea, methoxy-, 2249².
 $C_2H_5N_2O_4Pt$, 2621¹.
 $C_2H_5N_2S_2$ Carbazic acid, dithio-, Me ester, 3199⁴.
 $C_2H_5N_2O$ See *Urea, guanyl*.
 $C_2H_5N_2O_2$ Guanidine, α -methyl- γ -nitro-, 1968⁴.
 $C_2H_5N_2S_2$ Biurea, dithio-, 2901³.
 C_2H_5O See *Ethyl alcohol; Methyl ether*.
 C_2H_5OS Ethanol, 2-mercapto-, 3191¹.
 $C_2H_5O_2$ See *Glycol*.
 $C_2H_5O_2Zn$ See *Zinc methoxide*.
 $C_2H_5O_3S$ (See also *Methyl sulfate*).
 Carbinol, sulfonylbis-, 3171⁴.
 Ethylsulfuric acid, 53¹, P 1272⁷.
 $C_2H_7AsO_3$ See *Cacodylic acid*.
 $C_2H_7ClO_2CrN_2O_2 + 2H_2O$, 1601¹.
 C_2H_7N See *Ethylamine*.
 $C_2H_7NO_2$ See *Ammonium acetate*.
 $C_2H_7NO_3S$ See *Taurine*.
 $C_2H_7N_2$ See *Guanidine, methyl*.
 $C_2H_7Br_2CoO_2$ Addn. compd. of $CoBr_2$ and $MeOH$, 1235¹.
 $C_2H_7FeCl_4N$ Dimethylammonium tetrachloroferrate, 711².
 Ethylammonium tetrachloroferrate, 711⁴.
 $C_2H_7N_2$ See *Ethylenediamine*.
 $C_2H_7N_2O_4$ See *Ammonium oxalate*.
 $C_2H_7N_2O_4Pt_4S_2$, 3168¹.
 $C_2H_7N_2O_4Pt$, 2622¹.
 $C_2H_7CuN_2O_4S$, 3166⁹.
 $C_2H_7Cl_4N_2O_4Pt_2$, 2622¹.
 $C_2H_7N_2O_4Pt$, 2622¹.
 $C_2H_7Ag_2N_2O_4 + 6H_2O$ Silver-diamine nickel biuret, 866⁷.
 $C_2H_7CoN_2O_4S_2 + 3H_2O$, 27³.
 $C_2H_7Cl_4N_2O_4Pt_2$, 2622¹.
 $C_2H_7N_2O_4Pt_2$, 2622¹.
 $C_2H_7N_2O_2$ See *Mercury fulminate*.
 $C_2H_7N_2O_2$ Mercury oxycyanide, 797⁹.
 $C_2H_7N_2O_4$ Potassium sodium carbonate, 1743⁴.
 $C_2H_7O_2$ See *Potassium oxalate*.
 $C_2H_7MgN_2$ See *Magnesium cyanide*.
 $C_2H_7MgO_4$ See *Magnesium oxalate*.
 C_2N_2 See *Cyanogen*.
 $C_2N_2PtS_2$ Platinum thiocyanate, 3167⁹.
 C_2N_2Sn See *Tin cyanide*.
 C_2Na_3 See *Sodium acetylides*.
 $C_2Na_2O_4$ See *Sodium oxalate*.
 C_2NiO_4 See *Nickel oxalate*.
 C_2O_3Sr See *Sriontium oxalate*.
 C_2O_4Zn See *Zinc oxalate*.
 C_2Al See *Aluminum carbide*.
 $C_2Bi_2O_3$ See *Bismuth carbonate*.
 $C_2Br_2N_3$, 3170⁴.
 $C_2Br_2N_3Sb_2$ Addn. compd. of $BrCN$ and $SbBr_3$, 3170⁴.
 $C_2CrN_3S_2$ Chromium thiocyanate, 3572³.
 $C_2Eu_2O_3 + 3H_2O$ Europium carbonate, 1602⁴.
 $C_2GdN_3O_3 + 7H_2O$ Gadolinium thiocyanate, 365⁴.
 $C_2HBrClIO_3$ Pyruvic acid, bromochloroiodo-, 1444⁷.
 $C_2H_3CaK_2O_3 + 2H_2O$, 3322⁷.
 $C_2HN_3S_2$ Pseudothiocyanogen, 2120³.
 $C_2HO_3Rb_3P + 2H_2O$, 3322⁷.
 $C_2H_3BrClO_3$ Pyruvic acid, bromochloro-, 3600⁴.
 $C_2H_3O_2$ Propionic acid, and NH_4 salt, 54⁴, 55⁴; Na salt, 55⁴.
 $C_2H_3O_2$ Glyoxylic acid, formyl-, 2877⁴.
 $C_2H_3O_3$ See *Mesoxalic acid*.
 $C_2H_3O_3Sr + 2H_2O$, 3322⁷.
 $C_2H_3Ag_2N_3S_2$ 2,4-s-Triazinedimercaptan, 3,6-dihydro-, di-Ag deriv., 1101¹.
 $C_2H_3BiO_3$ Bismuth formate, 1520¹, 2359⁷.
 C_2H_3Br Propine, bromo-, 1795⁴, 2118¹.
 $C_2H_3BrCl_3$ Propene, 1-bromo-1,2-dichloro-, 2118¹.
 $C_2H_3BrCl_4$ Propane, 1-bromo-1,1,2,2-tetrachloro-, 2118⁴.
 $C_2H_3BrI_3$ Propene, 1-bromo-1,2-diiodo-, 2118⁴.
 C_2H_3BrO Acrolein, α -bromo-, 2659⁹.
 $C_2H_3Br_3$ Propane, 1,1,1,2,2-pentabromo-, 2118⁴.
 $C_2H_3Cu_2N_3S_2$ 2,4 - s - Triazinedimercaptan, 3,6-dihydro-, di-Cu deriv., 1101¹.
 $C_2H_3GdO_3$ Gadolinium formate, 365⁷.
 $C_2H_3Hg_2N_3S_2$ 2,4 - s - Triazinedimercaptan, 3,6-dihydro-, di-Hg deriv., 1101¹.
 C_2H_3NO Acetaldehyde, cyano-, 3888³.
 $C_2H_3NO_3S$ Rhodanin, 2432⁷.
 $C_2H_3N_2O_2$ Acetic acid, cyano-, 736¹.
 $C_2H_3NO_2$ 2,5 - Oxazolidione, 3,4 - dihydro-, 390³.

- C₂H₂N₂OS₂**: Hydropseudothiocyanic acid, 3465²; and salts, 2120⁴.
C₂H₂N₂O₂: Cyanuric acid, 1833³.
C₂H₂: Propene, 1036².
C₂H₂BrCl: Propene, 3-bromo-1-chloro-, 53⁷.
C₂H₂BrClO₂: Propionic acid, α -bromo- α -chloro-, 2875⁷.
C₂H₂ClNO: Lactonitrile, β -chloro-, 388².
C₂H₂Cl₂: Propene, 1,3-dichloro-, 730².
C₂H₂Cl₂O₂: Propionic acid, α , α -dichloro-, 2875⁷.
C₂H₂Cl₂NO₂: (See also *Volant.*)
 (1) Chloral formamide, 3067².
C₂H₂N₂: Imidazole, 1263², 2926².
C₂H₂N₂O: Oxamonitrile, methylamino-, 2132⁴.
 Pyrazolone, P 158², P 3105¹.
C₂H₂N₂OS₂: 1,3,4 - Thiodiazol - 2 - ol, 5 - methylmercapto-, 3190⁷.
C₂H₂N₂O₂S₂: 2,4-Thiazolodione, 3-amino-, -HCl, 2461.
C₂H₂N₂S₂: 1,3,4 - Thiodiazol - 2(3) - one, 5 - methylmercapto-2-thio-, 3199².
C₂H₂O: See *Acrolein*.
C₂H₂O₂: (See also *Pyruvaldehyde*.)
 Acrylic acid, 1730², 2661², P 3625².
C₂H₂O₂: (See also *Pyruvic acid*.)
 Pyruvaldehyde, hydroxy-, 2877².
C₂H₂O₄: See *Malonic acid*.
C₂H₂O₄: Tartaric acid, 1580⁴.
C₂H₂O₄: See *Mesoxalic acid*.
C₂H₂Br: Propene, 1-bromo-, 2117².
C₂H₂BrO: Propionaldehyde, α -bromo-, 1796².
C₂H₂BrO₂: Propionic acid, α -bromo-, 2413⁷.
C₂H₂Br₂O: Avertin, 2154².
C₂H₂Cl: Propene, 1 (and 2)-chloro-, 2657².
C₂H₂ClO: Epichlorohydrin, 2021², 2234², 5671², 1249², P 3434², 3889⁴.
 Propionaldehyde, β -chloro-, 3888²; *derivs.*, 1631².
 Propionyl chloride, 3043².
C₂H₂ClO₂: Acetic acid, chloro-, Me ester, 55².
 Formic acid, chloro-, Et ester, 1117².
C₂H₂ClO₂S: Propylene sulfite, 3-chloro-, 1796².
C₂H₂Cl₂NO: Propionamide, α , α -dichloro-, 2875⁷.
C₂H₂CoNO₂ + H₂O, 3327².
C₂H₂N: Propionitrile, 735², 1454¹.
C₂H₂NO: Lactonitrile, 735², 2000².
C₂H₂NO₂: Pyruvaldehyde, oxime, 565².
C₂H₂NO₂: Glycine, *N*-formyl-, 389².
 Malonaldehydic acid, oxime, 2875⁷.
C₂H₂N₂O₂: 2,4(1,3) - *s* - Triazinedione, dihydro-, 1101².
C₂H₂N₂O₂: See *Nitroglycerin*.
C₂H₂N₂S₂: 2,4(1,3) - *s* - Triazinedione, dihydro-2,4-dithio-, 1101².
C₂H₂NaO₂: Methylene, sodiumoxyethoxy-, 1795².
C₂H₂: See *Propene*.
C₂H₂BaClO₂P: Phosphoric acid, γ -chloro- β -hydroxypropyl ester, Ba salt, 2461².
C₂H₂BrClO: 2-Propanol, 1-bromo-3-chloro-, 3888¹.
C₂H₂Br₂: See *Propane, dibromo*-.
C₂H₂ClIO: 2-Propanol, 1-chloro-3-iodo-, 3888¹.
C₂H₂ClNO: Propane, 1-chloro-1-nitroso-, 1107².
C₂H₂Cl₂: Propane, 1,2-dichloro-, 2657².
C₂H₂Cl₂CuN₂O₂: Pyruvohydroxamic acid, oxime, CuCl₂ compd., 1097².
C₂H₂Cl₂O: 1-Propanol, 2,3-dichloro-, 55².
C₂H₂Cl₂NO₂: Acetic acid, trichloro-, MeNH₂ salt, 1630².
C₂H₂N₂: Cyanamide, dimethyl-, 1108².
 Glycinonitrile, *N*-methyl-, -HCl, 1795².
C₂H₂N₂O₂: Glyoxime, methyl-, 58².
C₂H₂N₂O₂: Pyruvohydroxamic acid, oxime, salts, 1097².
C₂H₂N₂: 1,2,3-Triazole, 1-amino-4-methyl-, 92².
C₂H₂N₂OS₂: 2,4-Thiazolodione, 3-amino-, hydrazone, di-HCl, 245².
C₂H₂N₂O₂: Urea, carbonylbis-, 8185².
C₂H₂O: (See also *Acetone*; *Allyl alcohol*.)
 Propene oxide, 1964², 3182².
 Propionaldehyde, 94², 688², 1097², 1964², 3149², 3525², 3888².
C₂H₂O₂: (See also "methyl ester" under *Acetic acid*; *Propionic acid*.)
 Formic acid, Et ester, P 2477².
C₂H₂O₂S₂: Propionic acid, β -mercapto-, Ni salt, 908².
C₂H₂O₂: (See also *Glyceraldehyde*; *Lactic acid*; *2-Propanone, dihydroxy*-.)
 Carbonic acid, di-Me ester, 1729²; mono-Et ester, 2413², 3526².
 Hydracrylic acid, 3889².
 Oxantin, 1690².
 Robinose, 938¹.
 Trioxymethylene, 1937².
C₂H₂O₂S: Trimethylene sulfite, 1796².
C₂H₂O₂S₂: 1,3 - Propanedisulfonic acid, 2 - keto-, di-K salt, 223².
C₂H₂O₂S₂: Propanetetrasulfonic acid, 2-keto-, and salts, 223².
C₂H₂S₂: Propionic acid, dithio-, 3609².
C₂H₂Se: 2-Propanone, 2-seleno-, 1963².
C₂H₂BaO₂P: See *Barium glycerophosphate*.
C₂H₂Br: See *Propane, bromo*-.
C₂H₂CaO₂P: See *Calcium glycerophosphate*.
C₂H₂ClO₂: 1,2-Propanediol, 3-chloro-, 56², 1796².
C₂H₂ClO₂S: Chlorosulfonic acid, Pr ester, 2659².
C₂H₂Cl₂NO₂: Acetic acid, dichloro-, MeNH₂ salt, 1630².
C₂H₂NO: Acetamide, *N*-methyl-, P 2273⁴.
 Acetone, oxime, ZnCl₂ addn. compd., 3346².
 Formimidic acid, Et ester, -HCl, 387².
C₂H₂NO₂: (See also *Alanine*; and "ethyl ester" under *Carbamic acid*.)
 Lactamide, sulfate, P 2907².
C₂H₂NO₂S: See *Cysteine*.
C₂H₂NO₂: Isoserine, 62².
C₂H₂NO₂S: Cysteic acid, 3064¹, 3185¹.
C₂H₂N₂O: Acetaldehyde, semicarbazone, 68².
C₂H₂N₂O₂S: Ethanesulfonic acid, 2-guanido-2-keto-, 62².
C₂H₂Na₂O₂P: Sodium glycerophosphate, 2205⁴.
C₂H₂O₂P: Propionic acid, α (and β)-phosphono-, 1627².
C₂H₂: See *Propane*.
C₂H₂ClNO: 2-Propanol, 1-amino-3-chloro-, 62².
C₂H₂N₂O: Urea, bis(hydroxymethyl)-, P 3907².
C₂H₂N₂O₂: Urea, ethoxy-, 2249².
C₂H₂N₂O₂: Urea, bis(hydroxymethyl)-, P 3481².
C₂H₂N₂O: Urea, α -guanyl- α -methyl-, -HCl, 899².
C₂H₂N₂O₂: Guanidine, α , α -dimethyl- γ -nitro-, 3348².
 Guanidine, α -ethyl- γ -nitro-, 1968².
 Urea, α , α' -methylenebis-, 1101².
C₂H₂N₂S₂: Urea, α , α' -methylenebis[thio-, 1101².
C₂H₂O: See *Isopropyl alcohol*; *Propyl alcohol*.
C₂H₂O₂: Methylal, P 745², 3298².
 1,3-Propanediol, 1796².
C₂H₂O₂: See *Glycerol*.
C₂H₂O₂S: Propylsulfuric acid, 53².
C₂H₂O₂P: Diphosphoglyceric acid, 2137².
C₂H₂AlO₂: See *Aluminum methoxide*.
C₂H₂As: Arsine, trimethyl-, 3043², 3612².
C₂H₂ClHg₂: Compd., m. 129², 3600¹.
C₂H₂N: Propylamine, 2659².
 Trimethylamine, 2255², 3188².
C₂H₂NO: 2-Propanol, 1-amino-, 1964².

- Trimethylamine, oxide, 595⁴.
C₂H₅NO₂ 1,2-Propanediol, 3-amino-, 62².
C₂H₅NO₂S Sulfamic acid, dimethyl-, Me betaine, 95¹.
C₂H₅NO₂F₂ Diphosphoglyceramide, 2137².
C₂H₅O₃P Glycerophosphoric acid, 57³, 1396⁴, 1630³.
C₂H₅AsO₃ 1,3-Propanediardsonic acid, 2-hydroxy-, 3232².
U₂H₁₀FeCl₄N Propylammonium tetrachloroferate, 711⁷.
 Trimethylammonium tetrachloroferrate, 711⁸.
C₂H₁₀N₂ 1,3-Propanediamine, 78⁹, 565⁷.
C₂H₁₁Cl₂N₂Pt, 3167⁷.
C₂H₁₁N₂ 1,2,3-Propanetriamine, salts, 388⁸, 3⁹.
C₂H₁₁Cl₂N₂Pt + H₂O, 3167^{4,5}.
C₂H₁₃Br₂Cl₂NO₂Pt Tetrabromo(triaminopropanemonohydrochloride)platinummonohydrate, 389¹.
C₂H₁₃Cl₂N₂O₂Pt Tetrachloro(triaminopropanemonohydrochloride)platinummonohydrate, 389¹.
C₂K₂MnN₂ Manganese potassium cyanide, 869².
C₂MoN₂S₂ See *Molybdenum thiocyanate*.
C₂Mo₂ See *Molybdenum carbide*.
C₂O₂ See *Carbon suboxide*.
C₂W₂ See *Tungsten carbides*.
C₂CaN₂Pt + 4H₂O Barium cyanoplatinite, 1772⁴.
C₂CdK₂N₂ Cadmium potassium cyanide, 1215⁴.
C₂Cl₄H₂O₂ Furan, tetrakis(chloromercuri)-, 2686⁴.
C₂CoHg₂N₂S₂ Mercury cobalthiocyanate, 1779⁴.
C₂EuK₂O₈ + 2H₂O Europium potassium oxalate, 1602⁴.
C₂FeO₄ Iron carbonyl, P 305⁵, P 3430⁷, 2⁹.
C₂GdK₂O₈ + 4H₂O Gadolinium potassium oxalate, 365⁹.
C₂GdNa₂O₁₂ + 13H₂O Gadolinium sodium carbonate, 365⁹.
C₂Gd₂K₂O₁₂ + 12H₂O Gadolinium potassium carbonate, 365⁹.
C₂HCl₄Hg₂N Pyrrole, 2,3,4,5-tetrakis(chloromercuri)-, 2686⁶.
C₂HLN Pyrrole, 2,3,4,5-tetraiodo-, 2686⁶.
C₂H₂ Biacetylene, 50⁸.
C₂H₂Br₂O₃ + 6H₂O, 3327².
C₂H₂Br₂Cl₂O₂ Succinyl chloride, α,β-dibromo-, 3616¹.
C₂H₂Br₂N₂O₂ Dibromin, 52².
C₂H₂Br₂ Butene, hexabromo-, 50⁸, 51⁸.
C₂H₂CdK₂O₈ + 1 or 3H₂O, 3322².
C₂H₂Cl₂O₂ Succinyl chloride, α,β-dichloro-, 3615⁹.
C₂H₂Cl₂O₂ Acetic acid, trichloro-, β-trichloro-ethyl ester, 387⁷.
C₂H₂CoK₂O₈, 3322².
C₂H₂Li 1,3-Butadiene, 1,2,3,4-tetraiodo-, 51⁸.
C₂H₂K₂O₂Zn, 3322².
C₂H₂N₂O₂ Alloxan, 2132⁷.
C₂H₂O₂ Maleic anhydride, 2432⁹.
C₂H₂Al₂Na₂O₆ Sodium aluminotartarate, 3321⁸.
C₂H₂BiK₂O₇ + 5H₂O, 2623⁴.
C₂H₂ClHgO Furan (chloromercuri)-, 2686⁶.
C₂H₂ClIN₂O₂ Isobarbituric acid, 6-chloro-, 1447⁸.
C₂H₂F₂O₂ Acetoacetic acid, γ-trifluoro-, 2120¹, 4⁴.
C₂H₂NO₂ s-Maleimide, 2875⁹.
C₂H₂NO₂ 1,3,2-Oxazine-2,6(3)-dione, 2875⁹.
C₂H₂N₂O₂ 1,3,4-Triazole, 1-acetyl-2,5-epoxy-, 2000⁴.
C₂H₂N₂O₂ Hydantoin, 5-nitromethylene-, 1447⁸.
 Violuric acid, 3298⁹.
C₂H₂BeCl₂N₂ Addn. compd. from succinonitrile and BeCl₂, 1601⁸.
C₂H₂BeCl₂N₂ Addn. compd. of HCN and BeCl₂, 1601⁸.
C₂H₂BiClK₂O₆ + H₂O, 2623⁴.
C₂H₂BiClNa₂O₆ + H₂O, 2623⁴.
C₂H₂BiClO₆ + 3H₂O, 2623⁴.
C₂H₂BiNa₂O, 2623⁴.
C₂H₂BrMgN Pyrrolmagnesium bromide, 1261⁸.
C₂H₂BrNS Isothiocyanic acid, β-bromoallyl ester, 53⁷.
C₂H₂CaN₂ 1,2,4-Triazole, Ca deriv., and NH₃ compd., 3054⁹.
C₂H₂Cl₂OS Sulfoxide, bis(β-chlorovinyl), 52⁹.
C₂H₂Cl₂O₂S Sulfone, bis(β-chlorovinyl), 52⁹.
C₂H₂Cl₂S Sulfide, bis(β-chlorovinyl), 53¹.
C₂H₂CuK₂N₂O Oxalohydroxamic acid, di-K cupriate, 1098¹.
C₂H₂CuNa₂O₂ Tartaric acid, Cu Na salt, 2232².
C₂H₂CuNa₂O₂ Sodium cupriglycolate, 3168².
C₂H₂CuO₂ + 3H₂O Tartaric acid, Cu salt, 2232².
C₂H₂KO₂Sb See *Tartar emetic*.
C₂H₂K₂N₂NO₂ Glyoxylohydroxamic acid, oxime, di-K nickelate, 1097⁷.
C₂H₂K₂N₂NO₂ Oxalohydroxamic acid, di-K nickelate, 1098¹.
C₂H₂K₂O₂ See *Potassium tartrate*.
C₂H₂MgN₂ 1,2,4-Triazole, Mg deriv., and NH₃ compd., 3054⁹.
C₂H₂MnNa₂O₁₀, 540².
C₂H₂N₂O₂ Uracil, 97³, 2875².
C₂H₂N₂OS₂ 1,3,4,6-Thiodiazin-6-one, 5-hydroxy-2-methylmercapto-, 3109⁹.
C₂H₂N₂O₂S₂ Acetic acid, [5-mercapto-2-(1,4,3-isothiodiazolyl)mercapto]-, and K salt, 383⁹.
C₂H₂N₂O₂ See *Barbituric acid*.
C₂H₂N₂O₂ Isodialuric acid, 1447⁸.
C₂H₂N₂Na₂NO₂ Glyoxylohydroxamic acid, oxime, di-Na nickelate, 1097⁷.
C₂H₂N₂Na₂NO₂ Oxalohydroxamic acid, di-Na nickelate, 1098¹.
C₂H₂O Furan, 86², 2432⁷, P 2907⁴, 3903⁸.
C₂H₂O₂ Succinic anhydride, 2432⁹.
C₂H₂O₂ (See *also Fumaric acid; Maleic acid*.)
 Oxalic acid, cyclic ethylene ester, 3358⁸.
C₂H₂O₂ Oxalacetic acid, 3633⁹.
 Succinic acid, α,β-epoxy-, and salts, 569⁴, 8⁸.
C₂H₂O₂ Fumaric acid, dihydroxy-, 569¹.
 Maleic acid, dihydroxy-, 569¹, 2664⁷.
C₂H₂S See *Thiophene*.
C₂H₂BrCl₂O Ether, β-bromo-α,β-dichlorovinyl ethyl, 2659⁴.
C₂H₂BrO₂ Cyclopropanecarboxylic acid, 2-bromo-(?), 3046⁸.
C₂H₂BrO₂ Succinic acid, bromo-, 3532⁷.
C₂H₂Br₂F₂ Propane, 2,3-dibromo-1-trifluoro-2-methyl-, 2658⁹.
C₂H₂Br₂Cl₂O Ether, ethyl α,β,β-tribromo-α,β-dichloroethyl, 2659⁴.
C₂H₂ClIN₂ Pyrazole, chloromethyl-, 2898⁹.
C₂H₂ClO₂ Glyoxylic acid, chloro-, Et ester, 1632², 3890².
C₂H₂ClO₂ Malic acid, chloro-, and salts, 569⁴, 570¹.
C₂H₂Cl₂O Butyryl chloride, α,α-dichloro-, 2875⁹.
 Ether, ethyl α,β,β-trichlorovinyl, 2659⁴.
C₂H₂Cl₂O₂ 1,3-Dioxolane, 2-(trichloromethyl)-, 1962².
C₂H₂CuNO₂ + 3H₂O Compd., decomps. 218⁹, from peptone, 2136⁴.
C₂H₂F₂ Propene, 3-trifluoro-2-methyl-, 2658⁹.

- C₂H₅KO₂: See *Potassium tartrate*.
 C₂H₅N: See *Pyrrrole*.
 C₂H₅NO β-Butenenitrile, α-hydroxy-, 735².
 C₂H₅NO Succinimide, 2877¹.
 C₂H₅NO₂ Maleamic acid, 2874².
 2,5-Oxazolidione, 3,4-dihydro-3-methyl-, 378¹, 389².
 C₂H₅NO₂ Acrylic acid, β-carboxyamino-, di-Na salt, 2875².
 C₂H₅NS Isothiocyanic acid, allyl ester, 290², 2759².
 C₂H₅N₂O (See also *Cytosine*.)
 Crotonyl azide, 3900².
 Isocrotonyl azide, 3900².
 Isocytosine, 97².
 C₂H₅N₂O₂ 5-Pyrazolecarboxylic acid, 4-amino-, 3904¹.
 Uracil, 5-amino-, 1968².
 C₂H₅N₂O₂ Isodialuric acid, oxime, 1447².
 C₂H₅ Bivinyll, 3786².
 C₂H₅AgN₂S₂ 1,4-s-Tetrazinedicarboxamide, 2,5-diaminodithio-, silver deriv., AgNO₃ addn. compd., 2901².
 C₂H₅BrClNO Acetamide, α-bromo-α-dichloro-N-ethyl-, 1446².
 C₂H₅BrN₂O Acrolein, α-bromo-, semicarbazone, 2659².
 C₂H₅Br₂ 2-Butene, 1,4-dibromo-, 1096².
 C₂H₅BrClNO Acetamide, α,α-dibromo-α-chloro-N-ethyl-, 1446².
 C₂H₅BrCoN₂ Addn. compd. of CoBr₂ and MeCN, 1235¹.
 C₂H₅Br₂O Butyraldehyde, α,α-dibromo-, 1796².
 C₂H₅ClNO Butyronitrile, γ-chloro-α-hydroxy-, 1631².
 C₂H₅ClCoN₂ Addn. compd. of CoCl₂ and MeCN, 1235¹.
 C₂H₅Cl₂O Ether, α,β-dichlorovinyl ethyl, 2659².
 C₂H₅Cl₂OS Sulfoxide, bis(α,β-dichloroethyl)-, 52².
 C₂H₅Cl₂S Sulfide, bis(α,β-dichloroethyl)-, 53¹.
 C₂H₅Cl₂HgNa₂O₂, 3570².
 C₂H₅CoO: See *Cobalt acetate*.
 C₂H₅CrCaNa₂S₄, 1587².
 C₂H₅CrKNa₂S₄, 1587².
 C₂H₅CrN₂NaS₂ + H₂O, 1587².
 C₂H₅CrO₂ Chromium acetate, 3572².
 C₂H₅CuN₂O Oxalohydroxamic acid, Cu deriv., di-K salt, 1098¹.
 C₂H₅CuO: See *Copper acetate*.
 C₂H₅HgNa₂S₂ 1,4-s-Tetrazinedicarboxamide,, 2,5-diaminodithio-, mercury deriv., HgCl₂ addn. compd., 2901².
 C₂H₅K₂O₂F₂Zn₂ + 2H₂O, 3327².
 C₂H₅MoO₂, 865².
 C₂H₅N₂O Glyoxime, dimethyl-, anhydride, 1446².
 5-Pyrazolone, 4-methyl-, 2898².
 C₂H₅N₂O₂ Acetic acid, diazo-, Et ester, 1580².
 Pumaramide, 1398².
 Hydrouracil, 97².
 Maleamide, 1398², 2875².
 2,5-Piperazinedione, 97², 567², 1288², 2008¹.
 C₂H₅N₂O₂S 2-Imidazolesulfonic acid, 4(or 5)-methyl-, 3615².
 C₂H₅N₂O₂S 2-Imidazolesulfonic acid, 4(or 5)-methyl-, 3615².
 C₂H₅N₂O₂ Formic acid, azobis-, di-Me ester, 1123².
 C₂H₅N₂S₂ 2,5-Piperazinedione, 2,5-dithio-, 98².
 C₂H₅N₂NO₂ Glyoxylohydroxamic acid, oxime, Ni deriv., and salts, 1097².
 C₂H₅N₂NO₂ Oxalohydroxamic acid, Ni deriv., salts, 1098¹.
 C₂H₅N₂O₂: See *Allanoin*.
 C₂H₅N₂PtS₂, 539².
 C₂H₅N₂PbS₂ 1,4-s-Tetrazinedicarboxamide, 2,5-diaminodithio-, lead deriv., PbO, addn. compd., 2901².
 C₂H₅N₂O₂: See *Nickel acetate*.
 C₂H₅O Crotonaldehyde, P 3474², 3888².
 C₂H₅O₂ Biacetyl, 1060², 2461², 3582², 3650².
 α,α'-Bi[ethylene oxide], 1096².
 Crotonic acid, 2661².
 Succinaldehyde, 3601².
 C₂H₅O₂: (See also *Acetic anhydride*; *Acetoacetic acid*.)
 Butyric acid, α-keto-, 2462², 3633².
 C₂H₅O₂: (See also *Succinic acid*.)
 Oxalic acid, dimethyl ester, 1216², 1383²; mono-Et ester, 3890².
 C₂H₅O₂Pb See *Lead acetate*.
 C₂H₅O₂PbS₂ Acetic acid, mercapto-, lead deriv., Na salt, P 3906².
 C₂H₅O₂Zn See *Zinc acetate*.
 C₂H₅O₂: See *Malic acid*.
 C₂H₅O₂: See *Tartaric acid*.
 C₂H₅O₂S Erythritol, disulfite, 1796².
 C₂H₅O₂U See *Uranyl acetate*.
 C₂H₅O₂S Succinic acid, sulfo-, 3351¹.
 C₂H₅O₂ Tartaric acid, dihydroxy-, 2664², 2899².
 C₂H₅AgO₂ Propionic acid, β-mercapto-, Me ester, Ag deriv., AgNO₃ compd., 908².
 C₂H₅AgNO₂S + H₂O Propionic acid, β-mercapto-, Me ester, Ag deriv., AgNO₃ compd., 908².
 C₂H₅Br Butene, bromo-, 396², 890², 2248².
 C₂H₅BrO Butyraldehyde, α-bromo-, 1796².
 C₂H₅BrNO Acetamide, α,α-dibromo-N-ethyl-, 1446².
 C₂H₅ClO Butyryl chloride, 3043².
 Isobutyryl chloride, 3043².
 C₂H₅ClNO Butyramide, α,α-dichloro-, 2875².
 C₂H₅CrN₂S₄, 1587².
 C₂H₅F₂O 2-Propanol, 1-trifluoro-2-methyl-, 2658².
 C₂H₅N Butyronitrile, 1454¹.
 C₂H₅NO Crotonamide, 894².
 C₂H₅NO₂ Biacetyl, monooxime, 565², 1446².
 C₂H₅NO₂ Alanine, β-formyl-(?), Ag salt, 382².
 Butyric acid, α-keto-, oxime, 2462².
 C₂H₅NO₂: See *Aspartic acid*.
 C₂H₅NO₂U Ammonium uranatomalate, 713².
 C₂H₅N₂O (See also *Creatinine*.)
 Urea, α-(cyanomethyl)-α-methyl-, 1795².
 C₂H₅N₂O₂ Biuret, 1-formyl-5-methyl-(?), 3353².
 Malonaldehyde acid, semicarbazone, 2875².
 C₂H₅: (See also *Butene*.)
 Cyclopropane, methyl-, 570², 1250¹.
 Propene, 2-methyl-, 903², 3344².
 C₂H₅BiNO₂, 2623².
 C₂H₅BrClO Ether, β-bromo-β'-chloroisopropyl methyl, 3888².
 C₂H₅BrN Allylamine, β-bromo-N-methyl-, and -HCl, 53².
 C₂H₅BrNO Acetamide, α-bromo-N-ethyl-, 2876².
 C₂H₅BrNO₂ Butane, 2-bromo-2-nitro-, 2871².
 C₂H₅BrO₂ Butyric acid, α-bromo-, 2413².
 C₂H₅Br₂ Propane, 1,2-dibromo-2-methyl-, 2457².
 C₂H₅ClN Allylamine, chloro-N-methyl-, and -HCl, 53².
 C₂H₅ClNO Butane, chloronitroso-, 1107², 2872².
 Propane, 1-chloro-2-methyl-1-nitroso-, 1107².
 C₂H₅ClNO₂ Butane, 2-chloro-2-nitro-, 2872².
 C₂H₅Cl₂N₂NO₂ Glyoxylohydroxamic acid, oxime, NiCl₂ compd., 1097².
 C₂H₅Cl₂O Ether, bis(β-chloroethyl)-, P 1548².

- Ether, dichloroethyl ethyl, 3298⁹.
 —, β , β' -dichloroisopropyl methyl, 3888¹.
 $C_2H_5O_2S$ See *Sulfide, bis-(β -chloroethyl)*.
 $C_2H_5O_2N_2O_2S$ Addn. compd. of $Co(SCN)_2$ and $MeOH$, 1235¹.
 $C_2H_5CuNO_2 + H_2O$ Ammonium cuprotartrate, 2322¹, 3325².
 $C_2H_5GdNO_2 + 4H_2O$ Ammonium gadolinium carbonate, 365⁹.
 $C_2H_5N_2$ Ethylenediamine, 3188⁹.
 Glycinonitrile, *N*-ethyl-, -*HCl*, 1795⁹.
 $C_2H_5N_2O$ Urea, propenyl-, 3900⁹.
 $C_2H_5N_2O_2$ Glyoxime, dimethyl-, 2119⁹.
 Succinamide, 1398⁷.
 $C_2H_5N_2O_2$ See *Asparagine; Glycine, glycol*.
 $C_2H_5N_2O_4$ 4 - Imidazolyl hydrogen peroxide, tetrahydro - 5 - hydroxy - 2 - keto - 4 (or 5)-methyl-, 1447².
 $C_2H_5N_2O_7$ Diethylene glycol-, dinitrate, 3120⁹.
 $C_2H_5N_2S$ See *Thiosinamine*.
 $C_2H_5N_2O_2$ Biuret, 1-nitroso-1,3-dimethyl-, 1633⁹.
 $C_2H_5N_2O_4$ Allantoic acid, 943⁹, 3070¹, 3385⁹.
 $C_2H_5N_2O$ 1,2,3,5 - Tetrazole - 1 - carboxamide, 4,5 - dihydro - *N* - methyl - 4 - methyl-imino(-?), 2132¹.
 $C_2H_5N_2S_2$ 1,4 - *s* - Tetrazinedicarboxamide, 2,5-diaminodithio-, and isomer, 2901⁴.
 C_2H_5O (See also *Butyraldehyde*.)
 2-Butanone, 565⁴, 1803¹, 3196⁹, 3582², 3888⁹.
 Butenol, 396⁹, 571¹, 3181⁷.
 Cyclobutanol, 571¹, 3181⁷.
 Cyclopropanecarbinol, 570⁹, 571¹, 3181⁷.
 Ethylene oxide, α , α -dimethyl-, 2271¹.
 Isobutyraldehyde, 3888⁹.
 $C_2H_5O_2$ (See also *Butyric acid; Ethyl acetate; Isobutyric acid*.)
 Aldol, 435⁴.
 2-Butanone, 3-hydroxy-, 2290⁹, 3582², 3645⁹.
 Δ^1 -1,4-Butenediol, 1096⁹.
 Dioxane, P 202¹, 1095⁷.
 Erythrol, 1096⁹.
 Ethylene oxide, (methoxymethyl)-, 3888¹.
 Formic acid, propyl ester, 3496².
 Propionic acid, methyl ester, 348⁹, 848⁷, 3496².
 $C_2H_5O_2S$ Butyric acid, β -mercapto-, 52⁹.
 Propionic acid, β -mercapto-, *Me* ester, 908².
 $C_2H_5O_2S_2$ *p*-Dithiane, 1,4-dioxide, 3599⁹.
 $C_2H_5O_2$ (See also *Butyric acid, hydroxy-*.)
 Isobutyric acid, hydroxy-, 3066⁹.
 $C_2H_5O_2$ Butyric acid, α , β -dihydroxy-, and salts, 3350⁴.
 Isobutyric acid, β , β' -dihydroxy-, salts, 896⁷.
 $C_2H_5O_2S$ Acetic acid, sulfo-, *Et* ester, *K* salt, 62⁹.
 Butyric acid, β -sulfo-, 52⁹.
 C_2H_5S Sulfide, ethyl vinyl, 2118².
 Thiophene, tetrahydro-, bromoplatinate, 1639⁴.
 $C_2H_5S_2$ Acetic acid, dithio-, *Et* ester, 3609².
 C_2H_5Se 2-Butanone, 2-seleno-, 1963².
 C_2H_5Br See *Butane, bromo-*.
 $C_2H_5BrO_2$ 2-Propanol, 1-bromo-3-methoxy-, 3888².
 C_2H_5Cl Propane, 1-chloro-2-methyl-, 55⁹, 1039⁴.
 C_2H_5ClO *tert*-Butyl hypochlorite, 3051⁴.
 $C_2H_5ClO_2$ 2-Propanol, 1-chloro-3-methoxy-, 567⁹, 3888¹.
 $C_2H_5ClO_2S$ Chlorosulfonic acid, isobutyl ester, 2659⁹.
 $C_2H_5IO_2$ 2-Propanol, 1-iodo-3-methoxy-, 3888².
 C_2H_5Li Lithium butyl, 3346².
 C_2H_5N Pyrrolidine, 583⁴, 1096¹.
 C_2H_5NO Acetamide, *N*-ethyl-, 895⁹.
 2-Butanone, oxime, *ZnCl_2* addn. compd., 3346⁷.
 $C_2H_5NO_2$ Butane, 2-nitro-, 2871¹.
 Glycolimide acid, *Et* ester, 388⁹.
 Isobutyl nitrite, 3530⁹.
 $C_2H_5NO_2$ Butyric acid, γ -amino- β -hydroxy-, 62⁹, 3892².
 Glycolhydroxamic acid, *Et* ester, 388⁹.
 C_2H_5NS Butyramide, thio-, 1454¹.
 $C_2H_5N_2$ Guanidine, α -allyl-, and salts, 62⁹.
 $C_2H_5N_2O_2$ (See also *Creatine*.)
 Biuret, 1,3-dimethyl-, 1633⁹.
 $C_2H_5NO_2S$ 2-Propanesulfonic acid, 2 - guanido-2-keto-, 62⁹.
 $C_2H_5N_2S$ Semicarbazide, 4-allylthio-, 2687⁹.
 C_2H_6 (See also *Butane*.)
 Propane, 2-methyl-, 1036², 3403⁹.
 C_2H_5AsCl Arsine, chlorodiethyl-, 3612⁴.
 $C_2H_5AuS_2$, 3495⁹.
 $C_2H_5ClO_2P$ Diethylphosphoryl chloride, 2457⁴.
 C_2H_5Mg Magnesium diethyl, 3345⁹.
 $C_2H_5MgO_2$ Magnesium ethoxide, P 3434¹.
 $C_2H_5NO_2$ Acetamide, α -amino-*N*-ethyl-, and -*HCl*, 1657⁴.
 $C_2H_5N_2O_2$ Guanidine, α -isopropyl - γ - nitro-, 3348⁹.
 Guanidine, α - nitro - γ - propyl-, 3348⁹.
 C_2H_5O (See also *Butyl alcohol; Ethyl ether; Isobutyl alcohol*.)
 2-Butanol, 564⁴, 1961⁹, 1962¹.
 $C_2H_5O_2$ Ethyl peroxide, 1932².
 $C_2H_5O_2S_2$ Ethane, 1,2-bis(methylsulfinyl)-, 3599⁹.
 $C_2H_5O_2$ Diethylene glycol, 1964².
 $C_2H_5O_2S$ 2-Butanesulfonic acid, *Na* salt, 2673⁷.
 $C_2H_5O_4$ See *Erythritol*.
 $C_2H_5O_2S$ Butylsulfuric acid, 53².
 Isobutylsulfuric acid, 53².
 C_2H_5Se Ethyl selenide, 323⁹, 1186⁴.
 $C_2H_5BiN_2O_7 + 2H_2O$, 2623⁴.
 C_2H_5N (See also *Diethylamine*.)
 Butylamine, 895⁴, 2659⁹.
 Isobutylamine, 2659⁹; -*HCl*, 1397².
 $C_2H_5NO_2$ Ethanol, β -(methoxymethylamino)-, and salts, 2248⁹.
 $C_2H_5NO_2S$ Sulfamic acid, diethyl-, *Ba* salt, 95¹.
 $C_2H_5BF_4N$ Tetramethylammonium fluoborate, 1070².
 $C_2H_5B_2O_5$ Addn. compd. of H_2BO_3 and tartaric acid, 1070².
 $C_2H_5Br_2CoO_2$ Addn. compd. of $CoBr_2$ and *EtOH*, 1235¹.
 $C_2H_5Br_2O$ Addn. compd. of *Et_2O* and *HBr*, 2592².
 $C_2H_5ClNO_4$ Tetramethylammonium perchlorate, 1397².
 $C_2H_5Cl_2CoO_2$ Addn. compd. of $CoCl_2$ and *EtOH*, 1235¹.
 $C_2H_5FeCl_4N$ Butylammonium tetrachloroferrate, 711⁷.
 Tetramethylammonium tetrachloroferrate, 711⁴.
 C_2H_5Ge Germane, tetramethyl-, 27⁴.
 $C_2H_5N_2$ 2,3-Butanediamine, and salts, 2119⁹, 2120¹.
 Putrescine, 1096¹, 2491¹.
 $C_2H_5N_2O_2P_2$, 2621¹.
 $C_2H_5N_2$ Guanidine, α , α' -ethylenebis-, and salts, 62⁹, 63¹.

- C₄H₁₂N₆NiO₆ Glyoxylohydroxamic acid, oxime, di-NH, nickelate, 1097⁴.
 C₄H₁₂Sn Stannane, tetramethyl-, P 3180⁴.
 C₄H₁₂CuN₂O₂ + 2H₂O Cupriguanidine biuret, 866⁴.
 C₄H₁₂NO Tetramethylammonium hydroxide, 1581².
 C₄H₁₂Cl₂NPt, 2856⁴.
 C₄H₁₂IN₂Sn Tetramethylammonium tin iodide, 3571².
 C₄H₁₂N₂O₂S Acetic acid, sulfo-, guanidine salt, 62².
 C₄H₁₂Ag₂Cl₂N₂Pt, 1417².
 C₄H₁₂B₂CuF₂N₄, 868².
 C₄H₁₂BeCl₂N₄ Addn. compd. of BeCl₂ and ethylenediamine, 1601².
 C₄H₁₂Cl₂CuN₂O₂, 868⁴.
 C₄H₁₂Cl₂CuN₂O₂ + .5H₂O, 868⁴.
 C₄H₁₂Cl₂N₂PtS₄, 539⁴.
 C₄H₁₂Cl₂CoN₄, 27⁴.
 C₄H₁₂Cl₂CrN₄, 3572⁴.
 C₄H₁₂Cl₂N₂NIPT, 1418¹.
 C₄H₁₂Cl₂N₂Pt, 1417².
 C₄H₁₂CoN₂Na₂O₂S + 3H₂O, 27².
 C₄H₁₂CuN₂O₂S, 3166².
 C₄H₁₂CuN₂O₂S₂, 3167¹.
 C₄H₁₂CuN₂O₂S₂, 868⁴.
 C₄H₁₂CuN₂O₂S₂, 3167¹.
 C₄H₁₂CuN₂O₂S₂, 3167¹.
 C₄H₁₂CuN₂O₂S₂, 3167¹.
 C₄H₁₂CuN₂O₂S₂, 3166².
 C₄H₁₂CuN₂O₂, 3166².
 C₄H₁₂FeCl₂N₂ Dimethylammonium pentachloroferrate, 711⁴.
 C₄H₁₂B₂CuF₂N₄, 868².
 C₄H₁₂Cl₂CuN₂O₂ + .5H₂O, 868⁴.
 C₄H₁₂CoN₂O₂P + 3H₂O, 366².
 C₄H₁₂CuN₂O₂P₂, 3166².
 C₄H₁₂CuN₂O₂S₂ + H₂O, 868⁴.
 C₄H₁₂FeCl₂N₂ + .5H₂O Methylammonium heptachlorohemiaquoferate, 711⁴.
 C₄H₁₂Mo₂N₁₂O₂S₁₂ + 10H₂O, 1939².
 C₄H₁₂Mo₂N₁₂O₂S₁₂ + 8H₂O, 1939².
 C₄H₁₂K₂N₂ Mercury potassium cyanide, 1215⁴.
 C₄I₂ Butadiene, diiodo-, 51².
 C₄I₂O Furan, tetraiodo-, 2686⁴, 2870⁴.
 C₄I₆ 1,3-Butadiene, hexaiodo-, 51⁴.
 C₄K Potassium carbide, 1582².
 C₄K₂N₂Ni Nickel potassium cyanide, 1065⁴, 1215⁴.
 C₄K₂N₂Pt + 3H₂O Potassium cyanoplatinite, 1772⁴.
 C₄K₂N₂Zn Potassium zinc cyanide, 1211⁴, 1215⁴.
 C₄Li₂N₂Pt + 3H₂O Lithium cyanoplatinite, 1772⁴.
 C₄MgN₂Pt Magnesium cyanoplatinite, 1572⁴, 1602⁴, 1772⁴.
 C₄NNa₂O₂Sr + H₂O, 3322².
 C₄NiO₂ See *Nickel carbonyl*.
 C₄AsFeN₂Na₂O₂, 3021⁴.
 C₄FeK₂N₂Na₂O₂, 3021⁴.
 C₄FeN₂Na₂O Sodium nitroprusside, 865², 3021⁴.
 C₄FeN₂Na₂O₂ Sodium nitroferrocyanide, 3021⁴, 3323².
 C₄FeN₂O Iron nitroprusside, 1769⁴.
 C₄FeO₂ See *Iron carbonyl*.
 C₄Fe₂N₂O₂S Iron ferro-sulfito-pentacyanide, 1769⁴.
 C₄HAAsNO₂ 2-Pyridol, 5-arsinoso-, 2902².
 C₄H₂BrClO₂ Glutaconic anhydride, α-bromo-β-chloro-, 3615².
 C₄H₂BrIN Pyridine, 3, 5-dibromo-2-iodo-, 3620¹.
 C₄E₂FeN₂Na₂O, 3021⁴.
 C₄H₂FeN₂Na₂O, 3021⁴.
 C₄H₂FeN₂Na₂O, 3021⁴.
 C₄H₂FeN₂O Iron ferriquo-pentacyanide, 1769⁴.
 Iron ferroquo-pentacyanide, 1769⁴.
 C₄H₂AsBrNO₂ Pyridine, 5-arsinoso-2-bromo-, 2902².
 C₄H₂AsBrNO₂ 2-Pyridol, 5-arsinoso-3-bromo-, 2902².
 C₄H₂AsClNO₂ Pyridine, 5-arsinoso-2-chloro-, 2902².
 C₄H₂AsClNO₂ 2-Pyridol, 5-arsinoso-3-chloro-, 2902².
 C₄H₂AsINO₂ Pyridine, 5-arsinoso-2-iodo-, 2902².
 C₄H₂AsINO₂ 2-Pyridol, 5-arsinoso-3-iodo-, 2902².
 C₄H₂BrIN Pyridine, bromoiodo-, 3620¹.
 C₄H₂BrO₂ α, γ-Pentadienic acid, α-bromo-β, δ, δ-trihydroxy-, δ-lactone, 1798².
 C₄H₂CIN₂ 1, 2, 3, 4-Pyridotriazole, 5(or 7)-chloro-, 1986⁴.
 C₄H₂ClO₂ Glutaconic anhydride, β-chloro-, 3615².
 C₄H₂CoNa₂O₂, 3327².
 C₄H₂FeN₂Na₂O, 3021⁴.
 C₄H₂FeN₂Na₂O, 3021⁴.
 C₄H₂FeN₂ Iron, ferriammonio-pentacyanide, 1769⁴.
 Iron ferroammonio-pentacyanide, 1769⁴.
 C₄H₂IN₂O₂ 2-Pyridol, 4-iodo-5-nitro-, P 414⁴.
 C₄H₂IN₂ Pyridine, 2, 5-diiodo-, 3620¹.
 C₄H₂INO₂ Pyridol, diiodo-, P 414⁴.
 C₄H₂BrClO₂ Glutaconic acid, α-bromo-β-chloro-, 3615².
 C₄H₂CINO₂ 1-Pyrrolicarboxylyl chloride, 1648².
 C₄H₂CINO₂ 2-Furanhydroxamyl chloride, 1106².
 C₄H₂IN Pyridine, iodo-, 1332², P 3370⁴.
 C₄H₂INO 2-Pyridol, 5-iodo-, P 2275⁴.
 C₄H₂N₂O₂ 2-Pyridol, 5-nitro-, 1814⁴.
 C₄H₂N₂O₂ 3, 5 - Pyrazoledicarboxylic acid, 4-hydroxy-, *Ag salt*, 3903².
 C₄H₂N₂ (See also *Purine*.)
 1, 2, 3, 4-Pyridotriazole, 1986⁴.
 C₄H₂N₂O See *Hypoxanthine*.
 C₄H₂N₂O See *Xanthine*.
 C₄H₂N₂O See *Uric acid*.
 C₄H₂O See 2-Furaldehyde.
 C₄H₂O₂ Pyromucic acid, 911², 2432², 3053².
 C₄H₂O₂ Acid from 2-furaldehyde, and *Ba salt*, 3053².
 C₄H₂AsBrClNO₂ 3-Pyridinearsonic acid, 5-bromo-6-hydroxy-, 2902².
 C₄H₂AsBrN Pyridine, 5-arsyl-2-bromo-, 2902².
 C₄H₂AsBrNO₂ 3-Pyridinearsonic acid, 6-bromo-, 2902².
 C₄H₂AsBrNO₂ Pyridinearsonic acid, bromo-hydroxy-, P 3626².
 C₄H₂AsClN Pyridine, 5-arsyl-2-chloro-, 2902².
 C₄H₂AsClNO₂ 3 - Pyridinearsonic acid, 6-chloro-, 1814², 2902².
 C₄H₂AsClNO₂ 3-Pyridinearsonic acid, 5-chloro-6-hydroxy-, 2902².
 C₄H₂AsIN Pyridine, 5-arsyl-2-iodo-, 2902².
 C₄H₂AsINO₂ 3-Pyridinearsonic acid, 6-iodo-, 2902².
 C₄H₂AsINO₂ 3-Pyridinearsonic acid, 6-hydroxy-5-iodo-, 2902².
 C₄H₂AsN₂O Pyridine, 2-amino-5-arsinoso-, 2902².
 C₄H₂AuN₂O₂S 4(or 5)-Imidazolecarboxylic acid, 2-(auromercapto)-5(or 4)-methyl-, 3615¹.
 C₄H₂BrO₂ α, γ-Pentadienic acid, bromo-, 2659².
 C₄H₂Br₂N₂O₂ Δ² - 1 - Pyrazolinedicarboxamide,

- 4,4 - dibromo - 5 - keto - 3 - methylthio-, 2128⁸.
- $C_6H_5BrN_2O_2$ Δ^2 - 1 - Pyrazolinecarboxamide, 4,4 - dibromo - 5 - keto - 3 - methyl-, 2128⁸.
- $C_6H_5ClH_2N_2O_2S$ 4(or 5) - Imidazolecarboxylic acid, 2 - (chloromercurimercapto) - 5 (or 4)-methyl-, 3615².
- $C_6H_5Cl_2CoN$ Addn. compd. of $CoCl_2$ and pyridine, 1235².
- $C_6H_5Cl_2N$ Pyridine, 2,3-diamino-4,5(or 5,6)-dichloro-, 1986².
- Pyrimidine, 2,6(and 4,6)-dichloro-4(and 2)-methylamino-, 2271⁸.
- $C_6H_5Cl_2O$ 1,3-Dioxol-4(5)-one, 5-methyl-2-(dichloromethyl)-, 1962².
- $C_6H_5CoCl_2PF_6 + 6H_2O$, 2231⁸.
- C_6H_5IN Pyridine, 2-amino-5-iodo-, P 414⁶, 1215⁴.
- C_6H_5IO Furan, 2-(iodomethyl)-, 1648⁴.
- C_6H_5N See *Pyridine*.
- C_6H_5NO Pyridine, *N*-oxide, and *-HCl*, 91⁸.
- 2-Pyrrolealdehyde, 86⁹.
- $C_6H_5NO_2$ 2-Furaldehyde, oxime, 754³, 3618⁶.
- 1-Pyrrolecarboxylic acid, 1648⁸.
- $C_6H_5NO_2S$ 1 - Hydroxypyridinium sulfonic acid, cyclic anhydride, 94⁹, 2472⁹.
- $C_6H_5N_2S$ 2 - Pyrrolecarboxylic acid, dithio, and salts, 1459^{8,7,8}.
- $C_6H_5N_3$ See *Adenine*.
- $C_6H_5N_3O$ (See also *Guanine*)
- Adenine, 2,3-dihydro-2-keto-, 3186⁸.
- $C_6H_5NaO_2$ α,γ -Pentadienaldehyde, δ -hydroxy-, Na deriv., 804⁹.
- C_6H_5 Cyclopentadiene, 1730⁸.
- C_6H_5AsNO 2-Pyridol, 5 arsyl-, 2902².
- $C_6H_5AsNO_3$ 3 Pyridinearsonic acid, 6-hydroxy-, P 3371², and salts, 2902².
- $C_6H_5BrN_2OS \Delta^2$ - 1 - Pyrazolinecarboxamide, 1-bromo-5-keto 3-methylthio-, 2128⁸.
- $C_6H_5BrO_2$ α,γ -Pentadienic acid, dibromide, 2659¹.
- $C_6H_5Br_2O$ Malonic acid, dibromo-, di-Me ester, 52².
- C_6H_5ClNO Lactonitrile, β -chloro-, acetate, 388⁶.
- C_6H_5ClN Pyridine, 2-chloro-5-hydrazino-, 1814⁸.
- Pyridine, 2,3-diaminochloro-, 1986².
- $C_6H_5Cl_2N_2O_2$ Ilydantoin, 1,3-dichloro-5,5-dimethyl-, 1795¹.
- $C_6H_5CoNO_2P + 5H_2O$, 2231⁸.
- C_6H_5IN Pyrimidine, iodo(methylamino)-, and *-HI*, 2271⁷.
- $C_6H_5IN_2O$ 4 - Pyrimidol, 6 - iodo - 2 - methylamino-, 2271⁸.
- $C_6H_5ILN_2Sn$, 3571⁸.
- $C_6H_5NO_2S_2U + 1$ or $3H_2O$, 712⁴.
- $C_6H_5N_2$ Glutaronitrile, 1108⁹.
- Pyridine, amino-, 94³, 246³, P 3370⁴.
- $C_6H_5N_2O$ Prolinamide, 87².
- 2-Pyrrolealdehyde, oxime, 86⁹.
- 1-Pyrrolecarboxamide, 1648⁸.
- $C_6H_5N_2OS$ 3(2) - Imidazo[2,3 - β]thiazolone, 5,6-dihydro-, 245⁸.
- $C_6H_5N_2O_2$ Thymine, 97².
- Uracil, methyl-, 97².
- $C_6H_5N_2OS$ Imidazolecarboxylic acid, 2 mercapto-5(or 4)-methyl-, 3614⁸.
- $C_6H_5N_2O_2$ Parabanic acid, dimethyl-, 3186².
- $C_6H_5N_2O_4$ 1,3,5,2 - Oxidiazine - 2,4,6(3,5)-trione, 3,5-dimethyl-, 1632⁹.
- $C_6H_5N_2NaO_2$ 1 - Imidazolecarboxamide, tetrahydro - 2,4 - diketo - 3 - methyl-, Na deriv. of isomer, 3353⁸.
- $C_6H_5N_2O_2$ Pyridine, hydrazinonitro-, P 594¹, P 2900¹, P 3909¹.
- $C_6H_5N_2OS \Delta^2$ - 1 - Pyrazolinecarboxamide, 4,5-diketo - 3 - methylthio-, 4-oxime, 2128⁸.
- $C_6H_5N_2O_2 \Delta^2$ - 1 - Pyrazolinecarboxamide, 4,5-diketo-3-methyl-, 4-oxime, 2128⁸.
- $C_6H_5N_2O_4$ 1 - Imidazolecarboxamide, tetrahydro-2,4 - diketo - 3 - methyl - *N* - nitro-, 3353².
- $C_6H_5N_2O_6$ 1 - Imidazolecarboxamide, tetrahydro - 5 - hydroxy - 2,4 - diketo - 3 - methyl-*N*-nitro-, 3353¹.
- C_6H_5O Furan, 3-methyl-, 2807¹.
- $C_6H_5O_2$ 2-Furancarbinol, 86², 2432⁷.
- γ -Pentenic acid, 3348⁷.
- $C_6H_5O_4$ Citraconic acid, 2583¹, 3104⁸.
- Itaconic acid, 3194⁷.
- Malonic acid, cyclic ethylene ester, 3358⁸.
- Mesaconic acid, 2583¹.
- Oxalic acid, cyclic trimethylene ester, 3358⁸.
- Paraconic acid, 2877⁸.
- $C_6H_5AsN_2O_2$ 3 - Pyridinearsonic acid, 6-amino-, 2902²; and salts, 1986².
- $C_6H_5BrN_2$ Cyanamide, (β -bromoallyl)methyl-, 53⁸.
- $C_6H_5Br_2ClO$ Valeryl chloride, α,δ -dibromo-, 2661⁸.
- $C_6H_5ClN_2$ Cyanamide, (chloroallyl)methyl-, 53⁸.
- Pyrazole, chlorodimethyl-, and salts, 2898^{8,9,8}.
- C_6H_5ClN Pyrazolediazonium chloride, dimethyl-, 2501⁷.
- $C_6H_5Cl_2O_2$ 5 - *m* - Dioxanol, 2 - (trichloromethyl)-(?), 1962⁸.
- 1,3 - Dioxolane - 4 - carbinol, 2 - (trichloromethyl)-(?), 1962⁸.
- C_6H_5NO Isoxazole, 3,5-dimethyl-, $ZnCl_2$ addn. compd., 3346⁷.
- Δ^2 - 2 - Pentenone, 4 - hydroxy-, oxime, anhydride, 1440⁸.
- $C_6H_5NO_2$ Acetic acid, cyano-, ethyl ester, 2879¹.
- Glutarimide, 1968¹.
- Succinimide, methyl-, 2877⁷.
- $C_6H_5N_2O_2$ 2,3,4 - Pentanetrione, 3 - oxime, 565¹.
- Pyroglutamic acid, 1678⁸.
- Pyrrolidinecarboxylic acid, keto-, 382².
- Pyrrolidinecarboxylic acid, hydroxy-, 382².
- $C_6H_5NO_2$ Acrylic acid, β -carbomethoxyamino-, 2874⁹.
- $C_6H_5N_2$ Pyridine, diamino-, and salts, 1986^{2,4}.
- Pyridine, 3-hydrazino-, P 3370⁴.
- Pyrimidine, 4-methylamino-, 2271⁷.
- $C_6H_5N_2OS \Delta^2$ - Pyrazolinecarboxamide, 4(and 5)-keto - 3 - methylthio-, and *-HCl*, 2128^{8,8}.
- $C_6H_5N_2O_2$ Allophanyl cyanide, α,γ -dimethyl-, 2132⁸.
- Pyrazole, dimethylnitro-, 2890².
- Δ^2 - 1 - Pyrazolinecarboxamide, 4(and 5)-keto-3-methyl-, and *-HCl*, 2128^{8,7}.
- $C_6H_5N_2O_2$ 1 - Imidazolecarboxamide, tetrahydro-2,4-diketomethyl-, 3352¹, 3353².
- $C_6H_5N_2O_4$ 1 - Imidazolecarboxamide, tetrahydro - 5 - hydroxy - 2,4 - diketo - 3 - methyl-, 3352⁹.
- $C_6H_5N_2O_4$ Isodialuric acid, semicarbazone, 1447⁸.
- C_6H_8 (See also *Isoprene*.)
- Cyclobutane, methylene-, 570⁷, 1249⁹.
- 1,2-Pentadiene, 3042¹.
- C_6H_5BrClO Valeryl chloride, δ -bromo-, 2661⁸.

- C₂H₅BrCl₂N** Propionimidyl chloride, α -bromo- α -chloro-*N*-ethyl-, 2875⁷.
C₂H₅Br₂ Cyclobutane, 1,2-dibromo-1-methyl-, 1250⁴.
C₂H₅Br₂O₂ Valeric acid, α , δ -dibromo-, 2661⁵.
C₂H₅ClN Valeronitrile, α -chloro-, 2271¹.
C₂H₅ClNO Propionitrile, β -chloro- α -ethoxy-, 388⁸.
C₂H₅ClN₂O₂Pt, 2621⁷.
C₂H₅ClN₂O₂Pt, 2621¹⁸.
C₂H₅Cl₂O₂ Propionic acid, α , α -dichloro-, ethyl ester, 2875⁸.
C₂H₅Cl₂N Propionimidyl chloride, α , α -dichloro-*N*-ethyl-, 2875⁸.
C₂H₅N₂ Pyrrole, 2-(aminomethyl)-, 871, 583¹.
C₂H₅N₂O 2(3) - Imidazolone, 1,3 - dimethyl-, 3353³.
C₂H₅N₂O₂ Hydantoin, 1,3-dimethyl-, 1795².
 2,5-Piperazinedione, 3-methyl-, 1680¹.
 Urea, crotonyl-, 894⁷.
C₂H₅N₂O₂ 2 - Pyrrolidinecarboxylic acid, 1-amino-5-keto-, and salts, 2807⁷.
C₂H₅N₂O₂ Hydouracil, 5,6-dihydroxy - 5-methoxy-, 1447⁸.
C₂H₅N₂O 1,2,4 - Triazole - 1 - carboxamide, 3,5-dimethyl-, 3200⁶.
C₂H₅N₂O₂ Glycoluril, 4-methyl-, 1447¹.
 α - Guanidinecarboxylic acid, α - cyano-, 890⁷.
C₂H₅N₂O₂Pt, 2621¹⁸.
C₂H₅O Cyclopentanone, 167¹, 2667⁹.
C₂H₅OS 1,4 - Thiopyrone, tetrahydro-, chloroplatinate, 1262².
C₂H₅O₂ Acetic acid, allyl ester, 1581¹.
 Δ^1 - 2 - Butenone, 4 - hydroxy - 3 - methyl-, 386⁷.
 2,4-Pentanedione, 55⁷, 543⁸, 841⁸, 1416⁹, 2872⁴; *U compds.*, 3357².
 α -Pentenic acid, 2661⁴.
 Valeric acid, γ -hydroxy-, lactone, 224⁵, 1096⁹, 1962¹.
C₂H₅O₂ Arabinol, 2120⁹, 2121⁵.
 Erythrol, formate, 1096⁴.
 Lactaldehyde, acetate, 1797⁸.
 Ribonic acid, lactone, 1446⁶.
C₂H₅O₂ (See also *Pyrotartaric acid.*)⁴.
 Malonic acid, dimethyl ester, 1216⁹.
C₂H₅O₂ Arabinic acid, lactone, 1446⁶.
C₂H₅Br 1-Butene, 1-bromo-3-methyl-, 2248⁶.
 Pentene, bromo-, 2248⁶, 3042².
C₂H₅BrClNO Propionamide, α -bromo- α -chloro-*N*-ethyl-, 2875⁷.
C₂H₅BrN₂O₂ Urea, (α -bromobutyl-), 804⁷.
C₂H₅BrO Isovaleraldehyde, α -bromo-, 1796¹.
 Valeraldehyde, α -bromo-, 1796¹, 3043⁸.
C₂H₅BrO₂ Valeric acid, δ -bromo-, 2661⁵.
C₂H₅BrNO Propionamide, α , α -dibromo-*N*-ethyl-, 1446¹.
C₂H₅Cl Butene, chloromethyl-, 2663⁴.
C₂H₅ClNO Propionamide, α , α -dichloro-*N*-ethyl-, 2875⁸.
C₂H₅Cl₂O 1-Propanol, 2-methyl-1-(trichloromethyl)-, 1625⁹.
C₂H₅I Cyclobutane, (iodomethyl)-, 1799¹.
C₂H₅N Valeronitrile, 2825⁹.
C₂H₅NOS 1,4 - Thiopyrone, tetrahydro-, oxime, 1262².
C₂H₅NO₂ (See also *Proline.*)
 2,4 - Pentanedione, monoxime, 1446⁹.
C₂H₅NO₂ See *Glutamic acid*.
C₂H₅N₂ See *Histamine*.
C₂H₅N₂O Urea, (α - cyanoisopropyl)-, 1794³.
 Urea, α - (cyanomethyl) - α - ethyl-, 1795².
- C₂H₅N₂O₂** Butyric acid, α -keto-, semicarbazone, 2462².
C₂H₅ Butene, methyl-, 3887^{2,3,4}.
 Pentene, 645¹, 1391¹, 1735¹, 3047⁷, 3887^{2,4}.
C₂H₅BrNO Propionamide, α -bromo-*N*-ethyl-, 1446¹.
C₂H₅Br₂ Butane, 2,3-dibromo-2-methyl-, 2457¹.
C₂H₅ClNO Butane, 2 - chloro - 3 - methyl - 2-nitroso-, 2872⁹.
 Pentane, chloronitroso-, 2872⁹.
C₂H₅ClNO₂ Lactic acid, β -chloro-, Et ester, 388⁸.
 Pentane, chloronitro-, 2872⁹, 2873¹.
 Propionamide, β -chloro- α -ethoxy-, 388⁸.
C₂H₅Cl₂O₂ 2 - Propanol, 1 - chloro - 3 - (β -chloroethoxy)-, 3889⁴.
C₂H₅Cl₂O₂Zr Addn. compd. of ZrCl₄ and lactic acid Et ester, 1069⁴.
C₂H₅N₂O Butyronitrile, α - amino - α - methyl-, and -HCl, 1795¹.
 Isobutyronitrile, α -methylamino-, and -HCl, 1793².
C₂H₅N₂O₂ 2,4 - Pentanedione, dioxime, 58¹, 1446⁹.
C₂H₅N₂O₂ Allophanic acid, α , γ -dimethyl-, Me ester, 1633³.
 Glutamine, 3479⁹.
C₂H₅N₂OS Semicarbazide, 4 - allyl - 2 - carbamylthio-, 1799¹.
C₂H₅N₂O₂ Biacetyl, 4-aminosemicarbazone, 1249¹.
C₂H₅N₂O₂ 2(3) - Imidazolone, 4(or 5) - carbamido - 4,5 - dihydro - 5(or 4) - hydroxy-4-methyl-, 1447².
 Oxamide, *N* - methyl - *N* - methylcarbamyl-, oxime, 2132⁸.
C₂H₅N₂O₂Pt, 2621¹⁸.
C₂H₅O Butyraldehyde, α -methyl-, 420².
 Cyclobutanecarbinol, 571¹, 3181¹.
 Cyclobutanol, methyl-, 571¹, 3181¹.
 Cyclopropanecarbinol, α methyl-, 571¹, 3181¹.
 Enanthaldehyde, 3888².
 Ethylene oxide, α -ethyl- α -methyl-, 2663⁴.
 Ethylene oxide, trimethyl-, 2271¹.
 Isovaleraldehyde, 1917².
 2-Pentanone, 2249⁷.
 Δ^1 -3-Pentenol, 564⁴, 731⁴.
C₂H₅O₂ Acetic acid, isopropyl ester, 387⁷; propyl ester, 348⁷, 3496².
 Butyric acid, methyl ester, 348⁹, 3496².
 Butyric acid, α -methyl-, 54⁴.
 Carbon monoxide, di Et acetal, 1795⁸.
 Formic acid, Bu ester, P 2477².
 Isobutyric acid, Me ester, 3496².
 Isovaleric acid, 459¹, 2087¹, 3008¹.
 Propionic acid, Et ester, 1453⁸, 3496².
 Valeric acid, 38⁴, 3008¹.
C₂H₅O₂ Ethyl carbonate, 1729².
 Lactic acid, Et ester, P 3057¹.
C₂H₅O₂ Acetin, mono-, 224¹.
C₂H₅O₂ (See also *Arabinose; Lyxose; Ribose; Xylose.*)
 Arabinodesonic acid, and Ba salt, 2121¹.
C₂H₅O₂S Propionic acid, α -sulfo-, Et ester, K salt, 62².
 Valeric acid, α -sulfo-, and salts, 3600^{1,2}, 3601^{1,2}.
C₂H₅S Sulfide, ethyl propenyl, 2118².
C₂H₅S Propionic acid, dithio-, Et ester, 3000¹.
C₂H₅Br Pentane, 3-bromo-, 563⁷.
C₂H₅BrO₂ Propionaldehyde, α -bromo-, di-Me acetal, 1796².

- $C_5H_{11}Cl$ Pentane, 3-chloro-, 5637.
 $C_5H_{11}ClN_2O_2Pt$, 26217.
 $C_5H_{11}ClN_2O_2Pt$, 26217.
 $C_5H_{11}ClO$ 2-Butanol, 1-chloro-2-methyl-, 26634.
 $C_5H_{11}ClO_2$ Propane, 1-chloro-2,3-dimethoxy-, 38882.
 2-Propanol, 1-chloro-3-ethoxy-, 5672.
 $C_5H_{11}ClO_2S$ Chlorosulfonic acid, isoamyl ester, 26594.
 $C_5H_{11}Cl_2N_2O_2Pt$, 31678.
 $C_5H_{11}F$ Butane, 1-fluoro 3-methyl-, 38879.
 $C_5H_{11}IO$ 2-Pentanol, 5-iodo-, 19621.
 $C_5H_{11}N$ (See also *Piperidine*.)
 Pyrrolidine, 2-methyl-, 5832.
 $C_5H_{11}NO$ Acetamide, *N*-propyl-, 8954.
 Formamide, *N*, *N*-diethyl-, 33461.
 2-Furanmethylaniline, tetrahydro-, 33624.
 3-Pentanone, oxime, $ZnCl_2$ addn. compd., 33467.
 Propionamide, *N*-ethyl-, 14462.
 $C_5H_{11}NO_2$ (See also *Amyl nitrite*; *Betaine*.)
 Alanine, *N*-ethyl-, 28765.
 Lactimidic acid, Et ester, 3884.
 Valeric acid, amino-, and *Cu* salt, 5733.
 Valine, 29334.
 $C_5H_{11}NO_2$ Isoamyl nitrate, 557.
 Lactohydroxamic acid, Et ester, 3885.
 Valeric acid, α (and γ)-amino- β -hydroxy-, 8982.
 $C_5H_{11}N_2$ Cyanamide, diethyl-, 14077.
 $C_5H_{11}N_2O$ 2-Butanone, semicarbazone, 684.
 Guanidine, α -butyryl-, -*HCl*, 627.
 —, α -isobutyryl-, salts, 628.
 $C_5H_{11}N_2O_2S$ 2-Butanesulfonic acid, 1-guanido-1-keto-, 627.
 2-Propanesulfonic acid, 1-guanido-1-keto-2-methyl-, 628.
 $C_5H_{11}N_2O_2Pt$, 26218.
 $C_5H_{11}N_2O_2Pt$, 26218.
 C_5H_{12} (See also *Butane*, 2-methyl-, *Pentane*.)
 Propane, 2,2-dimethyl-, 38871.
 $C_5H_{12}Hg$ Butyl methyl mercury, 2334.
 $C_5H_{12}NO_2S$ Isoamylsulfuric acid, 537.
 $C_5H_{12}O$ Pivalic acid, hydrazide, 14556.
 $C_5H_{12}N_2O_2$ Ornithine, 3904.
 Urea, α , α -diethyl- β -hydroxy-, 5704.
 $C_5H_{12}N_2O_2$ Ornithine, γ -hydroxy-, 624.
 $C_5H_{12}N_2S$ Tetramethylammonium thiocyanate, 32264.
 $C_5H_{12}N_2O_2$ Guanidine, α -butyl- γ -nitro-, 19686.
 Guanidine, α isobutyl- γ -nitro-, 33489.
 $C_5H_{12}N_2S_2$ Tetramethylammonium dithiotriazofornate, 32264.
 $C_5H_{12}O$ (See also *Amyl alcohol*; *Isoamyl alcohol*.)
tert-Amyl alcohol, 30672.
 Butanol, methyl-, 21842, 38878.
 Ethylene oxide, α -ethyl- α -methyl-, 38894.
 Pentanol, 19621, 21842, 38877.
 $C_5H_{12}O_2$ 1,2-Butanediol, 2-methyl-, 26634.
 1,4-Pentanediol, 19621.
 $C_5H_{12}O_2$ Orthoformic acid, di-Et ester, *Na* salt, 16284.
 $C_5H_{12}Cl_2N$ (β -Chloroethyl)trimethylammonium chloride, 24594.
 $C_5H_{12}Cl_2N_2O_2Pt$, 31677.
 $C_5H_{12}N$ Isoamylamine, 8954.
 Propylamine, *N*, *N*-dimethyl-, 26604.
 $C_5H_{12}NO_2$ See *Muscaine*.
 $C_5H_{12}N_2$ Guanidine, α , α -diethyl-, and -*HCl*, 28784; salts, 14634.
 Guanidine, γ -ethyl- α , α -dimethyl-, and salts, 624.
 —, α , α , γ -tetramethyl-, and salts, 28784.
 $C_5H_{12}OP$ Phosphine oxide, diethylmethyl-, 662.
- $C_5H_7INO_2$ (β -Hydroxyethyl)methoxydimethylammonium iodide, 22489.
 $C_5H_7N_2$ Cadaverine, 2067.
 2,4-Pentanediamine, 8687.
 $C_5H_7N_4$ See *Agmatine*.
 $C_5H_7N_6$ Guanidine, α , α' propylenebis-, and salts, 631.
 Guanidine, α , α' -trimethylenebis-, and salts, 631.
 $C_5H_7ClN_2$ (β -Aminoethyl)trimethylammonium chloride, 24594.
 $C_5H_7NO_2$ See *Choline*.
 $C_5H_7CuN_2O_2 + 2H_2O$, 31668.
 $C_5H_7FeCl_2N_2O_2$, 7114.
 $C_5H_7Mo_2N_2O_2S_2 + 7H_2O$, 19397.
 $C_5H_7Mo_2N_2O_2S_2 + 9H_2O$, 19397.
 $C_5H_7Mo_2N_2O_2S_2 + 9H_2O$, 19398.
 $C_5K_2MnN_2O_2$ Manganese nitrosocyanide, 10683.
 C_5O_2 , 24362.
 $C_5Ag_2N_2O_2$ 2,2'-Bimidazole, 1,5,1',5'-tetra-nitro-, di-Ag deriv., 33643.
 $C_6AlK_2O_{12} + 3H_2O$ Aluminum potassium oxalate, 14167.
 $C_6BrCl_2O_2$ Quinone, 2-bromo-6-chloro-3,5-di-iodo-, 5742.
 $C_6BrCl_2O_2$ Quinone, 2-bromo-3,5,6-trichloro-, 5742.
 $C_6Br_2Cl_2O_2$ Quinone, 2,6-dibromo-3-chloro-5-iodo-, 5742.
 $C_6Br_2Cl_2O_2$ Quinone, dibromodichloro-, 5742, 12541, 36063.
 $C_6Br_2O_2$ Quinone, 2,6-dibromo-3,5-diiodo-, 5744.
 $C_6Br_3ClO_2$ Quinone, 2,3,5-tribromo-6-chloro-, 5744.
 $C_6Br_4O_2$ Quinone, tetrabromo-, 20137.
 $C_6Ca_2FeN_6$ See *Calcium ferrocyanide*.
 $C_6Ce_2O_{12}$ Cerium oxalate, 19397.
 $C_6Cl_2O_2$ Quinone, 2,6-dichloro-3,5-diiodo-, 36064.
 $C_6Cl_2N_2O_2S$ 3,4-Benzothiodiazoledione, 5,6-dichloro-, 26907.
 $C_6Cl_2O_2$ Diquinoyl, *p*-dichloro-, 724.
 $C_6Cl_2O_2$ Quinone, tetrachloro-, 5754, 8437.
 C_6Cl_6 Benzene, hexachloro-, 30474.
 $C_6CoK_2N_6$ Potassium cobaltcyanide, 10637, 10654, 17774.
 $C_6CrK_2N_6$ Potassium chromicyanide, 10637.
 $C_6CrK_2N_6S_2$ Potassium chromithiocyanate, 35724.
 C_6CrO_3 Chromium carbonyl, 35714.
 $C_6Cr_2FeS_2$, 26424.
 $C_6Cu_2FeN_6$ See *Copper ferrocyanide*.
 $C_6Eu_2O_{12} + 10H_2O$ Europium oxalate, 16024.
 $C_6FeGdKN_6 + 5H_2O$ Gadolinium potassium ferrocyanide, 3659.
 $C_6FeGdN_6 + 4.5H_2O$ Gadolinium ferricyanide, 3659.
 $C_6FeK_2N_6$ See *Potassium ferricyanide*.
 $C_6FeK_2N_6$ See *Potassium ferrocyanide*.
 $C_6FeN_2Na_4$ See *Sodium ferrocyanide*.
 $C_6FeN_2Na_4O_2S$, 30214.
 $C_6Gd_2O_{12}$ Gadolinium oxalate, 19322.
 C_6HBrCl_2O Phenol, 3-bromo-5-chloro-2,4,6-triiodo-, 5744.
 $C_6HBrCl_2NO_2$ Picric acid, 3-bromo-5-chloro-, 5744.
 $C_6HBrCl_2NO_2$ Phenol, 3-bromo-2,4,6-trichloro-5-nitro-, 36064.
 C_6HBrCl_2O Phenol, 3-bromo-2,4,5,6-tetrachloro-, 36064.
 C_6HBrCl_2O Phenol, dibromochlorodiiodo-, 5744, 5754.

- C₆HBr₂ClN₂O₅** Phenol, dibromochlorodinitro-, 574^{4,7}, 3606⁵.
C₆HBr₂ClO₂ Quinone, 3,5-dibromo-2-chloro-, 574⁴.
C₆HBr₂ClIO Phenol, 3,5-dibromo-2,4-(and 2,6)-dichloro-6-(and 4)-iodo-, 574^{4,5}.
C₆HBr₂ClNO₂ Phenol, 3,5-dibromo-2,4-(and 2,6)-dichloro-6-(and 4)-nitro-, 574^{4,5}.
C₆HBr₂Cl₂O Phenol, dibromotrichloro-, 574^{3,9}.
C₆HBr₂ClNO₂ Phenol, 2,4,6-tribromo-3-chloro-5-nitro-, 574³, 3606².
C₆HBr₂Cl₂O Phenol, tribromodichloro-, 574^{4,5}, 3606².
C₆HBr₂ClO Phenol, tetrabromochloro-, 574^{5,6,9}.
C₆HBr₂O Phenol, pentabromo-, 1407⁷.
C₆HCl₂O₂ Quinone, 2-chloro-3,5-diiodo-, 574⁴.
C₆HCl₂O Phenol, 3,5-dichloro-2,4,6-triiodo-, 3606².
C₆HCl₂N₂O₅ 4-Benzothiodiazolol, 3,5,6-trichloro-, 2690⁷.
C₆HCl₂O₂ Quinone, trichloro-, 575⁵, 843³.
C₆HCl₂N₂O₅ Phenol, 2,3,4,6-tetrachloro-5-nitro-, 3606².
C₆HCl₂N₂O₅ 4(3) - Benzothiodiazolone, 3,3,5,5,6 - pentachloro - 5,6 - dihydro-, 2690⁷.
C₆HCl₂O₂S₂ *m*-Benzenedisulfonyl chloride, 2673³.
C₆HFeN₂Na₂O₅ 866².
C₆H₂AgIN₂O₄ Phenol, iododinitro-, Ag deriv., 1974^{3,5}.
C₆H₂BrClIN₂O₄ Phenol, 5-bromo-3-chloro-2,4-dinitro-, 574⁹.
C₆H₂BrClO₂ Quinone, 2-bromo-6-chloro-, 3606⁵.
C₆H₂BrCl₂O Phenol, 3-bromo-2,4,6-trichloro-, 3606⁴.
C₆H₂BrN₂O₅ 5-Benzothiodiazolol, 6-chloro-4-nitro-, 2690⁸.
C₆H₂Br₂ClNO Quinonimine, 2,6-dibromo-, *N*-chloro-, 1946³.
C₆H₂Br₂Cl₂O Phenol, 3,5 dibromo-2,4-(and 2,6)-dichloro-, 574^{4,5}.
C₆H₂Br₂N₂O₅ 5-Benzothiodiazolol, 4,6-dibromo-, 2690⁸.
C₆H₂Br₂ClO Phenol, tribromochloro-, 574⁷, 3606^{2,5}.
C₆H₂Br₂ClO₂ Resorcinol, 2,4,6-tribromo-5-chloro-, 575².
C₆H₂Br₂IO₂ Resorcinol, 2,4,6-tribromo-5-iodo-, 575².
C₆H₂Br₂NO₂ Phenol, 3,4,6-tribromo-2-nitro-, 3606¹.
C₆H₂Br₂O *p*-Benzenone, 2,4,4,6-tetrabromo-, 52².
C₆H₂Br₂O₂ Pyrocatechol, tetrabromo-, 1640¹.
C₆H₂Cl₂NO₂ Benzene, chlorodiodonitro-, 2883⁹.
C₆H₂Cl₂ Benzene, chlorotriiodo-, 2883⁹.
C₆H₂Cl₂O Phenol, 3-chloro-2,4,6-triiodo-, 574⁴.
C₆H₂ClIN₂O₄ Picryl chloride, 93⁸.
C₆H₂Cl₂N₂O₅ 3,4-Benzothiodiazole, 5,6-dichloro-, 2690⁷.
C₆H₂Cl₂N₂O₄ Phenol, 3,6-dichloro-2,4-dinitro-, 2692².
C₆H₂Cl₂O₂ Quinone, dichloro-, 575⁵, 843³, 1253⁹.
C₆H₂Cl₂O₂S₂ *m*-Benzenedisulfonyl chloride, 4,5-dihydroxy-, sulfate, 72³.
C₆H₂Cl₂NO Quinonimine, *N*,2,6-trichloro-, 1946³.
C₆H₂Cl₂O₂ Hydroquinol, tetrachloro-, 843³.
C₆H₂FI₂ Benzene, fluorotriiodo-, 2883⁹.
C₆H₂IN₂O₄ Picric acid, 3-iodo-, 1974³.
C₆H₂IN₂O *p*-Quinonediazide, 2,6-diiodo-, 91¹.
C₆H₂I₂N₂O₄ 3,4,5-Triiodobenzenediazonium nitrate, 90⁸.
C₆H₂N₂Na₂O₄ 2,2'-Bi[imidazole]-1,1'-diol, 5,5'-dinitro-, di-Na deriv., 3364⁴.
C₆H₂N₂O₄ 2,2'-Biimidazole, 1,5,1',5'-tetranitro-, 3364⁴.
C₆H₂O₂ Propiolic anhydride, 54².
C₆H₂AgO Furan, 2-ethynyl-, silver deriv., 2896⁴.
C₆H₂BrClIO Phenol, 4-bromo-2-chloro-6-iodo-, 3605⁷.
C₆H₂BrMgO 2-Furyl ethynylmagnesium bromide, 2896⁴.
C₆H₂BrN₂O₅ Benzothiodiazolol, bromo-, 2690⁸.
C₆H₂Br₂ClO Phenol, dibromochloro-, 574^{4,7,9}.
C₆H₂Br₂ClO₂ Hydroquinone, 3,5-dibromo-2-chloro-, 574⁴.
C₆H₂Br₂O Phenol, 2,4,5-tribromo-, 3606¹.
C₆H₂Cl₂O Phenol, 2-chloro-4,6-diiodo-, 3606⁴.
C₆H₂ClIN₂O₅ Benzothiodiazolol, chloro-, 2690⁸.
C₆H₂ClIN₂O Benzene, 1-chloro-2,4-dinitro-, 404⁴.
C₆H₂ClIN₂O₅ Benzenesulfonyl chloride, 2,4-dinitro-, 2692².
C₆H₂ClO₂ Quinone, chloro-, 575⁵, 843³.
C₆H₂Cl₂NO₂ Phenol, 2,5-dichloro-4-nitro-, 2692².
C₆H₂Cl₂ Benzene, 5-trichloro-, 2673³.
C₆H₂Cl₂O Phenol, 2,4,6-trichloro-, 573³.
C₆H₂Cl₂O₂ Hydroquinone, trichloro-, 843³.
C₆H₂Cl₂O₂S₂ *m*-Benzenedisulfonyl acid, 2,4,6-trichloro-, and salts, 2673³.
***m*-Benzenedisulfonyl chloride**, 5-chloro-4,6-dihydroxy-, 2676⁷.
C₆H₂Cl₂S Benzenesulfonyl chloride, 2,5-dichloro-, 3355⁴.
C₆H₂ClIN Aniline, 2,3,5,6-tetrachloro-, 904¹.
C₆H₂CuO Furan, 2-ethynyl-, cuprous deriv., 2896⁴.
C₆H₂FI₂O₂ 1-Phenol-4-sulfonyl fluoride, 2,6-diiodo-, 3605⁴.
C₆H₂FI₂NO₂S₂ *m*-Benzenedisulfonyl fluoride, 4-hydroxy-5-nitro-, 3605².
C₆H₂IN₂O₄ Benzene, 1-iodo-3,5-dinitro-, 2671⁷.
C₆H₂IN₂O Phenol, iododinitro-, 1974³.
C₆H₂MnO₄ 539⁹.
C₆H₂NO₂ 2-Furancarboxylic acid, 3-cyano-, 2896⁴.
C₆H₂N₂NaO₄ Sodium phenoxide, dinitro-, 323³, 2675⁷.
C₆H₂N₂O₅ Benzothiodiazole, 4-nitro-, 2690⁸.
C₆H₂N₂O₅ Benzothiodiazolol, nitro-, 2690⁸.
C₆H₂N₂O See *Benzene, trinitro-*.
C₆H₂N₂O See *Picric acid*.
C₆H₂N₂O₄ 2,2'-Biimidazole, 1,5,1'-trinitro-(?), 3364⁴.
C₆H₂AgN₂O₄ Hydroxylamine, nitrophenylnitroso-, silver deriv., 3048⁸.
C₆H₂Ag₂O₂V Silver vanadylmalonate, 2230⁸.
C₆H₂BF₂N₂O₂ *o*(*m* and *p*)-Nitrobenzenediazonium fluoroborate, 2668⁵.
C₆H₂BaO₂V Barium vanadylmalonate, 2230⁸.
C₆H₂BrClO Phenol, 3-bromo-5-chloro-, 574⁴.
C₆H₂Br₂ Benzene, *p*-dibromo-, 3047⁴.
C₆H₂Br₂O Furan, 2-bromo-5-(*β*-bromovinyl)-, 2895⁵.
C₆H₂CaO₂V Calcium vanadylmalonate, 2230⁸.
C₆H₂ClFN₂O₅ *m* - (Fluorosulfonyl)benzenediazonium chloride, *SnCl₄ compd.*, 3604².
C₆H₂ClFO₂S₂ *m*-Benzenedisulfonyl 3-chloride 1-fluoride, 4-hydroxy-, 3605².
C₆H₂ClIN₂O Benzene, chloronitro-, 3047⁴, 3611¹.
C₆H₂ClIN₂O₅ Benzenediazonium sulfate, 4-chloro-3-nitro-, 2800⁷.
C₆H₂ClO₂P Pyrocatechylphosphorus oxychloride, 2461⁷.

- $C_6H_4Cl_2$ See *Benzene, dichloro*.
 $C_6H_4Cl_2FIO_2S$ Benzenesulfonyl fluoride, *m*-iodo-, dichloride, 3604².
 $C_6H_4Cl_2O$ Phenol, 2,6-dichloro-, 2255⁸.
 $C_6H_4Cl_2O_2$ Hydroquinone, 2,6-dichloro-, 843⁸.
 $C_6H_4Cl_2O_3S$ Chlorosulfonic acid, *p*-phenylene ester, 1639⁴.
 $C_6H_4Cl_2O_6S_2$ *m*-Benzenedisulfonic acid, 4,6-dichloro-, and *di-K* salt, 2673⁸.
 m -Benzenedisulfonyl chloride, 4,5-dihydroxy-, 724.
 $C_6H_4Cl_2O_6S_2$ *m*-Benzenedisulfonyl chloride, trihydroxy-, 2676⁸.
 $C_6H_4Cl_2S$ Benzenesulfonyl chloride, 4-chloro-, 3355⁴.
 $C_6H_4Cl_2N$ Aniline, trichloro-, 904¹.
 $C_6H_4Cl_2O_2P$ Pyrocatechylphosphorus trichloride, 2461⁴, 3056⁹.
 $C_6H_4Cs_2O_4V$ Cesium vanadylmalonate, 2230⁸.
 $C_6H_4FIO_2S$ Benzenesulfonyl fluoride, *m*-iodo-, 3604².
 $C_6H_4F_2O_2S$ Benzenesulfonyl fluoride, *m*-nitro-, 3604².
 $C_6H_4FNO_2S$ 1-Phenol-4-sulfonyl fluoride, 2-nitro-, 3605¹.
 $C_6H_4F_2O_2S_2$ *m*-Benzenedisulfonyl fluoride, 4-hydroxy-, 3605¹.
 $C_6H_4INO_2$ Phenol, iodonitro-, 1971^{1,2}.
 $C_6H_4I_2O_2$ Resorcinol, 4,6-diiodo-, 2671¹.
 $C_6H_4K_2O_4V$ Potassium vanadylmalonate, 2230⁸.
 $C_6H_4Li_2O_4V$ Lithium vanadylmalonate, 2230⁸.
 $C_6H_4N_2OS$ Benzothiodiazolol, 2690⁸.
 $C_6H_4N_2O_2$ Quinonodioxime, 2013⁹.
 $C_6H_4N_2O_2$ See *Benzene, dinitro*-.
 $C_6H_4N_2O_2$ See *Phenol, dinitro*-.
 $C_6H_4N_2NaO$ Hydrosylamine, nitrophenyl-nitroso-, sodium deriv., 3048⁷, 3049².
 $C_6H_4N_2Na_2O_4$ Hydrosylamine, dinitrosophenyl-enedi-, sodium deriv., 3049⁴.
 $C_6H_4N_2O_4$ 2,2'-Biimidazole, 1,5'-dinitro-, 3364⁴.
 $C_6H_4N_2O_6$ 2,2'-Biimidazole-1,1' diol, 5,5'-dinitro-, 3364⁵.
 $C_6H_4N_2O_4V$ Sodium vanadylmalonate, 2230⁸.
 C_6H_4O Furan, 2-ethynyl-, 2896².
 $C_6H_4O_2$ See *Quinone*.
 $C_6H_4O_2S$ Pyrocatechol, 1,2-sulfite, 1639⁸.
 $C_6H_4O_2$ 2-Furancarboxylic acid, 3-formyl-, 2896⁸.
 $C_6H_4O_2$ 2,3-Furandicarboxylic acid, 2896⁸.
 $C_6H_4O_2PbV$ Lead vanadylmalonate, 2230⁸.
 $C_6H_4O_2RbV$ Rubidium vanadylmalonate, 2230⁸.
 $C_6H_4O_2SrV$ Strontium vanadylmalonate, 2230⁸.
 $C_6H_4O_2TLV$ Thallium vanadylmalonate, 2230⁸.
 $C_6H_4BF_4N_2$ Benzenediazonium fluoborate, 1070³, 2230⁴, 2668⁴.
 $C_6H_4BIO_2$ Citric acid, Bi salt, 2350⁸.
 C_6H_4Br See *Benzene, bromo*-.
 C_6H_4BrMg Phenylmagnesium bromide, 1626⁸, 1800¹, 3354⁴.
 C_6H_4BrO Furan, (bromovinyl)-, 2896².
 $Phenol, p$ -bromo-, 573⁹.
 $C_6H_4BrO_2$ Resorcinol, bromo-, 236², 575².
 $C_6H_4BrO_2Se$ Benzeneseleninic acid, *p*-bromo-, 1252².
 $C_6H_4BrO_2$ 3-Furancarboxylic acid, bromo-2-(hydroxymethyl)-, 2896⁹.
 C_6H_4Cl See *Benzene, chloro*-.
 $C_6H_4ClIN_2$ Benzenediazonium chloride, 12², 572⁷.
 $C_6H_4ClIN_2O_2$ Aniline, 4-chloro-3-nitro-, 2800⁷.
 $C_6H_4ClIN_2O_2$ Isobarbituric acid, 6-chloro-, acetate, 1447⁸.
 C_6H_4ClO Phenol, chloro-, 573⁹, 2084⁴, 3189⁷.
 $C_6H_4ClO_2$ Elsholtzyl chloride, 2890⁸.
 $Hydroquinone, chloro$ -, 843⁸.
 $Resorcinol, 5$ -chloro-, 575².
 $C_6H_4ClO_2$ 2-Furancarboxyl chloride, 5-(hydroxymethyl)-, 3912⁸.
 $C_6H_4Cl_2N$ Aniline, dichloro-, 904¹.
 $C_6H_4Cl_2NS$ Phenyl mercaptan, 2-amino-4,6-dichloro-, 2688⁹.
 $C_6H_4CsO_4V$ Cesium vanadylmalonate, 2230⁸.
 C_6H_4F See *Benzene, fluoro*-.
 $C_6H_4FO_2S$ Benzenesulfonyl fluoride, 3603⁹.
 $C_6H_4FO_2S$ 1-Phenol-4-sulfonyl fluoride, 3604⁹.
 $C_6H_4F_2NO_2S_2$ *m*-Benzenedisulfonyl fluoride, 5-amino-4-hydroxy-, 3605².
 C_6H_4HgIN Aniline, 2-(and 4)-iodo-4-(and 2)-(iodomercuri)-, 396^{2,3}.
 C_6H_4I Benzene, iodo-, 1106¹.
 C_6H_4IO Phenol, *m*-iodo-, 1974¹.
 $C_6H_4IO_2$ Benzene, iodoxy-, 572⁷.
 $Resorcinol, 5$ -iodo-, 575².
 $C_6H_4KO_2S$ Phenyl potassium sulfate, 95².
 $C_6H_4KO_4V$ Potassium vanadylmalonate, 2230⁸.
 C_6H_4NO Benzene, nitroso-, 1800¹, 2127².
 $C_6H_4NO_2$ (See also *Benzene, nitro* -; *Nicotinic acid*.)
 $Phenol, p$ -nitroso-, 2013⁸.
 $Picolinic acid$, 2493², 2848³.
 $C_6H_4NO_2$ (See also *Phenol, nitro* -.)
 $Puran, 2$ -(β -nitrovinyl)-, 2895⁸.
 $C_6H_4NO_2$ 2-Furancarboxylic acid, 3-formyl-, oxime, 2896⁸.
 $Quinone, 2,5$ -dihydroxy-, 4-oxime, 575⁷.
 $C_6H_4N_3$ *p*-Quinonediazide, -HCl, and *SbCl_5* compds., 1105^{3,4}.
 $C_6H_4N_2O_4$ Hydroxylamine, (nitrophenyl)nitroso-, 904¹, 3048⁷, 3049².
 $1,3,5,7$ -(2,6,7a) -Isimidazimidazoletetrone, 2-methyl-, 3353¹.
 $C_6H_4N_2S$ Benzothiodiazole, 4-amino-, 2690⁸.
 $C_6H_4O_2RbV$ Rubidium vanadylmalonate, 2230⁸.
 C_6H_6 See *Benzene*.
 $C_6H_4AsBr_3$ Arsine, tris(β -bromovinyl)-, 1962⁴.
 $C_6H_4AsNO_2$ Benzenearsonic acid, *p*-nitro-, P 3371².
 $C_6H_4AsNO_2$ Benzenearsonic acid, 4-hydroxy-3-nitro-, P 249¹.
 C_6H_4BrN Aniline, bromo-, 1071¹.
 $C_6H_4BrO_2P$ Phosphoric acid, *p*-bromophenyl ester, and salts, 2460⁸, 2461^{1,3}.
 $C_6H_4Br_6$ Cyclohexane, hexabromo-, 517².
 $C_6H_4ClIN_2$ *m*-Phenylenediamine, 4-chloro-6-iodo-, 2671⁴.
 C_6H_4ClIN Aniline, chloro-, 1071¹, P 3058².
 $C_6H_4ClINOS$ Phenol, 4-amino-2-chloro-5-mercapt-, -HCl, 2092².
 $C_6H_4ClO_2Sb$ Benzenestibonic acid, *p*-chloro-, P 249¹.
 $C_6H_4Cl_2N_2O$ Phenol, 2,3-dichloro-4-hydrazino-, -HCl, 2690⁹.
 $Pyrimidine, 2,4$ -dichloro-6-ethoxy-, 2271⁹.
 $C_6H_4Cl_6$ Cyclohexane, hexachloro-, 517².
 $C_6H_4F_2INO_2S$ 1-Phenol-4-sulfonyl fluoride, 2,6-diiodo-, NH_4 deriv., 3605⁴.
 $C_6H_4FNO_2S$ Metanilyl fluoride, and -HCl, 3604².
 $C_6H_4FNO_2S$ 1-Phenol-4-sulfonyl fluoride, 2-amino-, and -HCl, 3605².
 $C_6H_4FNO_2S_2$ 1-Phenol-4-sulfonyl fluoride, 2-sulfamyl-, 3605².
 C_6H_4HgINO Aniline, 2-(and 4)-(hydroxymercuri)-4-(and 2)-iodo-, 396^{2,3}.
 $C_6H_4HgO_2$ Furan, (acetoxymercuri)-, 2686⁷.
 C_6H_4IN Aniline, iodo-, 395⁹.
 $C_6H_4KO_2P$ Phenyl potassium phosphate, 423⁴.
 $C_6H_4N_2O_2$ (See also *Aniline, nitro* -.)

- Hydroxylamine, β -nitroso- β -phenyl-, 904³, 3296⁴.
- C₆H₅N₂O₂S Aniline, 2-mercapto-5-nitro-, 2690⁶.
- C₆H₅N₂O₂S₂ 1,3,4-Octathiodiazine, 5-hydroxy-8-keto-2-methylthiol-, 3199⁴.
- C₆H₅N₂O₂ Phenol, 2-amino-3-nitro-, 2675⁴, 2695⁵.
- Pyridine, 2-methoxy-5-nitro-, 1814³.
- Quinone, 2-amino-5-hydroxy-, 1-oxime, 1537⁷.
- C₆H₅N₂O₂S₂ 1,3,4,6-Thiodiazin-6-one, 5-hydroxy-2-methylmercapto-, acetate, 3199⁶.
- C₆H₅N₂ Acetonitrile, nitrilotris-, 737¹.
- 2,2'-Biimidazole, 3364¹.
- C₆H₅N₂O₂S₂ 1,4,3-Isithiodiazin-5-ol, 2,2'-dithiobis-, 383³.
- C₆H₅N₂O₂ Uric acid, 1 (and 7)-methyl-, 899³.
- C₆H₅N₂O₂ Hydroxylamine, β , β' -*p*-phenylenebis(β -nitroso-, 904⁴, 3049⁴.
- C₆H₅N₂O₂ 2,2'-Biimidazole, 1-amino-5'-nitro-, 3364⁴.
- C₆H₅O (See also Phenol.)
- Furan, 2-vinyl-, 2896¹.
- C₆H₅O₂ (See also Hydroquinone; Pyrocatechol; Resorcinol.)
- 2-Furaldehyde, methyl-, 3185⁶.
- C₆H₅O₂ (See also Phloroglucinol; Pyrogallol.)
- Elsholtzic acid, and salts, 2896⁸.
- 2-Furaldehyde, (hydroxymethyl)-, 582⁹, 1458⁷, 3185⁹.
- C₆H₅O₂S See Benzenesulfonic acid.
- C₆H₅O₂ Malonic acid, propargyl-, 3348⁷.
- Muconic acid, 3800⁶.
- C₆H₅O₂S *p*-Phenolsulfonic acid, Ba salt, 95.
- C₆H₅O₂ Aconitic acid, 3047⁸.
- C₆H₅O₂S₂ *m*-Benzenedisulfonic acid, 2,4,6-trihydroxy-, di-K salt, 2676⁸.
- C₆H₅O₂V Vanadylmalonic acid, 2230⁷.
- C₆H₅O₂S₂ 1,3,5-Benzenetrissulfonic acid, 2,4,6-trihydroxy-, and salts, 2676⁸.
- C₆H₅S Phenyl mercaptan, 1100¹.
- C₆H₅AsNNaO₂ See Atoxyl.
- C₆H₅AsO₂ Benzenearsonic acid, *p*-hydroxy-, 3890⁴.
- C₆H₅BrN₂ *p*-Phenylenediamine, 2-bromo-, 2671⁵.
- C₆H₅BrN₂O₂ Muconamide, α -bromo-, 1632⁶.
- C₆H₅BrO₂ Sorbic acid, bromo-, 2659².
- C₆H₅ClN₂O Pyrazole, acetylchloromethyl-, 2899¹.
- C₆H₅F₂NO₂S₂ *m*-Benzenedisulfonyl fluoride, 1-hydroxy-, NH₂ deriv., 3605².
- C₆H₅F₂O₂ Acetoacetic acid, γ -trifluoro-, Et ester, 2120^{1,2}.
- C₆H₅IN₂ *p*-Phenylenediamine, 2-iodo-, 2671⁵.
- C₆H₅N (See also Aniline.)
- Picoline, 486³, 573⁴, 1460⁶.
- C₆H₅NO Hydroxylamine, β -phenyl-, 736¹, 3895⁷.
- Phenol, amino-, 234⁹.
- C₆H₅NO₂ Elsholtzamide, 2896⁷.
- Resorcinol, amino-, 2440⁹.
- C₆H₅NO₂ 4 (or 5)-Imidazolepyruvic acid, and -HCl, 91⁷.
- C₆H₅NO₂S Sulfamic acid, phenyl-, K salt, 95¹.
- Sulfanilic acid, 1131¹, 3047⁵; Na salt, 95².
- C₆H₅NO₂ Aspartic anhydride, *N*-acetyl-, 61⁵.
- C₆H₅N₂O₂ 2-Furaldehyde, semicarbazone, 68⁸.
- C₆H₅N₂O₂ Quinone, 3,5-diamino-2-hydroxy-, 1-oxime, 575⁸.
- C₆H₅O₂Sh Benzenesulfonic acid, P 249¹.
- C₆H₅O₂P Phosphoric acid, Ph ester, salt, 2461^{1,2}.
- C₆H₅ 1,3,5-Hexatriene, 2117⁴.
- C₆H₅AsNO₂ See Aspirochyl.
- C₆H₅AsNO₂ Arsanilic acid, hydroxy-, 3596^{4,5}.
- C₆H₅Br₂ 2,4-Hexadiene, 1,6-dibromo-, 2117⁴.
- C₆H₅Br₂N₂O₂ 2,5-Piperazinedione, 1,4-dibromo-3,6-dimethyl-, 3892⁶.
- C₆H₅Br₂O₂ α , γ -Pentadienic acid, dibromide, Me ester, 2659¹.
- C₆H₅Br₂ Hexane, 1,2,3,4,5,6-hexabromo-, 1964⁴.
- C₆H₅ClNO₂ Butyronitrile, γ -chloro- α -hydroxy-, acetate, 1631⁷.
- C₆H₅Cl₂NO₂ 1,3,2-Oxazin-2-one, tetrahydro-4-hydroxy-4-methyl-6-(trichloromethyl)-, 3614³.
- C₆H₅Cl₂O₂S Hexamethylene sulfite, tetrachloro-, 1790⁴.
- C₆H₅CuNa₂O₂ Sodium cuprilactate, 3168⁹.
- C₆H₅FNO₂S 1-Phenol-4-sulfonyl fluoride, NH₂ deriv., 3604⁹.
- C₆H₅N₂ See Hydrazine, phenyl-; Phenylenediamine.
- C₆H₅N₂O₂ 2,5-Piperazinedione, 3-methyl-6-methylene-, 846³.
- Uracil, 1,3-dimethyl-, 97³.
- C₆H₅N₂O₂S₂ 1,3,4-Octathiodiazine, 6,7-dihydro-5-hydroxy-8-keto-2-methylthiol-, 3199⁶.
- C₆H₅N₂O₂ Barbituric acid, dimethyl-, 3185⁶.
- 4-Imidazolecarboxylic acid, 2,3-dihydro-2-keto-1,3-dimethyl-, and Ag salt, 3353⁶.
- Isobarbituric acid, 1,3-dimethyl-, 1447⁷.
- C₆H₅N₂O₂ Glyoxyldihydroxamic acid, oxime, di-Ac deriv., 1097⁸.
- C₆H₅N₂O₂S₂ *m*-Benzenedisulfonamide, 4-hydroxy-, 3605².
- C₆H₅N₂O₂ Cupferron, *p*-nitro-, 3048⁸.
- C₆H₅N₂O₂ 1-Imidazolecarboxamide, 3-ethyltetrahydro-2,4-diketo-*N*-nitro-, 3352².
- C₆H₅O Sorbaldehyde, 891⁹.
- C₆H₅O₂ Furan, 2-(methoxymethyl)-, 1648¹.
- C₆H₅O₂ Adipic anhydride, 1968³.
- C₆H₅O₂S 1,2-Thiopyran-3-carboxylic acid, 5,6-dihydro-4-hydroxy-, Ba salt, 1262⁷.
- 1,2-Thiopyran-3-carboxylic acid, 3,4,5,6-tetrahydro-4-keto-, Ba salt, 1262⁷.
- C₆H₅O₂ Fumaric acid, dimethyl ester, 1398⁷.
- Maleic acid, dimethyl ester, 1398⁷.
- Paraconic acid, 2-methyl-, 2877⁸.
- Succinic acid, cyclic ethylene ester, 3358⁴.
- C₆H₅O₂ 2,5-Furandicarboxylic acid, tetrahydro-, 3890⁴.
- C₆H₅O₂ (See also Citra acid.)
- 2,5-Anhydromannosaccharic acid, 3892¹.
- 2,5-Anhydrosaccharic acid, 3892¹.
- C₆H₅O₂S Mannitol, trisulfite, 1796⁴.
- C₆H₅AlO₂ See Aluminum acetate.
- C₆H₅As₂NO₂ Benzenearsonic acid, 3,4-diamino-, 2255⁷.
- C₆H₅As₂NO₂ Benzenearsonic acid, 3,5-diamino-2-hydroxy-, 2695².
- C₆H₅BiO₂ See Bismuth acetates.
- C₆H₅BrO₂ Δ^2 -Pentenone, 3-bromo-4-methyl-, 565⁴.
- C₆H₅ClN₂ Pyrazole, chlorotrimethyl-, 2895^{4,5}.
- C₆H₅ClN₂O₂ Isobarbituric acid, 6-chloro-5,6-dihydro-5,6-dimethoxy-, 1447⁹.
- C₆H₅ClN₂ Pyrimidine, 4-chloro-2,6 bis(methylamino)-, 2271⁷.
- C₆H₅ClO₂ Δ^2 -Pentenone, 8-chloro-4-methyl-, 565⁴, 892².
- C₆H₅ClO₂ β -Pentenic acid, γ -chloro- α -methyl-, 385⁹.
- C₆H₅ClO₂ Isobutyryl chloride, α -hydroxy-, acetate, 3611⁷.
- C₆H₅ClO₂ Malic acid, chloro, di-Me ester, 570¹.

- $C_6H_5Cl_3O$ 2-Pentanone, 3,3,4-trichloro-4-methyl-, 565^a.
- $C_6H_5Cl_3O_2$ Acetic acid, trichloro-, Bu ester, 55^a.
- $C_6H_5EuO_5 + 4H_2O$ Europium acetate, 1602^a.
- C_6H_5N Crotononitrile, α -ethyl-, 2118^a.
- α -Pentenonitrile, α -methyl-, 2118^a.
- Pyrrrole, 3,4-dimethyl-, 85^a.
- C_6H_5NO Cyclopentanenitrile, 1-hydroxy-, 1635^a.
- $C_6H_5NO_2$ Glutaramide, β -methyl-, 1968^a.
- Succinimide, α, α -dimethyl-, 2877^a.
- , ethyl-, 2877^a.
- $C_6H_5NO_2$ Butyric acid, α, β -diketo-, Et ester, α -oxime, 565^a.
- $C_6H_5N_2$ Hydrazine, (o-aminophenyl)-, 2132^a.
- $C_6H_5N_2O_2$ (See also *Histidine*.)
- Cupferron, 736^a, 3575^a.
- $C_6H_5N_3O_2$ 1-Imidazolecarboxamide, *N*-(and 3)-ethyltetrahydro-2,4-diketo-, 3352^a.
- 1-Imidazolecarboxamide, tetrahydro-2,4-diketo-*N*, 3-dimethyl-, 3352^a.
- 1,3,5,2-Oxadiazine-2,4(3)-dione, 5,6-dihydro-3,5-dimethyl-6-methylimino-, 1632^a.
- Piperazinedione, glycol-, 1661^a.
- $C_6H_5N_3O_4$ Hydantoin, 3,5,5-trimethyl-1-nitro-, 1795^a.
- $C_6H_5N_3S_2$ Δ^2 -1,3,4-Thiadiazole, 5-(allylimino)-2-methylmercapto-, 3200^a.
- $C_6H_5O_2Ti$ Thallium acetate, 1492^a.
- C_6H_{10} (See also *Cyclohexene*.)
- Biallyl, 1735^a.
- Bicyclo[0.2.2]hexane, 2464^a.
- Butadiene, dimethyl-, 3766^a.
- 2,4-Hexadiene, 1964^a.
- Hexene, 730^a.
- $C_6H_{10}BeCl_2N_2$ Addn compd. from propionitrile and $BeCl_2$, 1601^a.
- $C_6H_{10}BrNO_2$ Sarcosine, *N*-(α -bromopropionyl)-, 1004^a.
- $C_6H_{10}Br_2$ Hexane, dibromo-, 730^a.
- $C_6H_{10}Br_2O_2$ Caproic acid, α, ϵ -dibromo-, 2661^a.
- $C_6H_{10}Br_4$ Hexane, 2,3,4,5-tetrabromo-, 1964^a.
- $C_6H_{10}ClIN_2$ 4-Chloro-1,2,3-trimethylpyrazolium iodide, 2898^a.
- $C_6H_{10}ClIN$ Isocaproitrile, α -chloro-, 2271^a.
- $C_6H_{10}ClNO$ Cyclohexane, 1-chloro-1-nitroso-, 2873^a.
- $C_6H_{10}ClNO_2$ Butyric acid, γ -amino- β -hydroxy-, chloroacetate, 62^a.
- $C_6H_{10}Cl_2O$ 2-Pentanone, 3,4-dichloro-4-methyl-, 565^a.
- $C_6H_{10}Cl_2O_2$ Butyric acid, α, α -dichloro-, ethyl ester, 2875^a.
- $C_6H_{10}Cl_2N$ Butyrimidyl chloride, α, α -dichloro-*N*-ethyl-, 2875^a.
- $C_6H_{10}Cl_2NO_2$ Lactamide, β -trichloro-*N*-propyl-, 1095^a.
- $C_6H_{10}Cl_2O_2$ 1,6-Hexanediol, 2,3,4,5-tetrachloro-, 1796^a.
- $C_6H_{10}IN_3O_2$ Trimethylnitropyrazolium iodide, 2899^a.
- $C_6H_9N_2O$ 2(3)-Imidazolone, 1,3,4-trimethyl-, 3353^a.
- 5-Pyrazolone, 1,3,4-trimethyl-, 2898^a.
- $C_6H_9N_2O_2$ Hydantoin, 1-ethyl-3-methyl-, 1795^a.
- Hydantoin, 1,5,5-trimethyl-, 1795^a.
- 2,5-Piperazinedione, 3,6-dimethyl-, 567^a.
- $C_6H_9N_2O_2S$ Acetic acid, (4,5-dihydro-2-imidazolylmercapto)-, Me ester, 245^a.
- $C_6H_9N_2O_2$ 2-Pyrrolidinedicarboxylic acid, 1-amino-5-keto-, methyl ester, $\cdot HCl$, 2897^a.
- $C_6H_9N_2O_4$ Formic acid, azobis-, di-Et ester, 1123^a.
- $C_6H_9N_2O_5$ Hydrouacil, 5-ethoxy-5,6-dihydroxy-, 1447^a.
- Hydrouacil, 6-hydroxy-5,5-dimethoxy-(?), 1447^a.
- Isobarbituric acid, 5,6-dihydro 5,6-di-methoxy-(?), 1447^a.
- $C_6H_9N_2S$ Imidazole, 2-(ethylmercapto)-4(or 5)-methyl-, and chloroaurate, 3614^a.
- $C_6H_9N_4$ (See also *Cardiazole*.)
- Pyrimidine, 2,4-bis(methylamino)-, 2271^a.
- $C_6H_{10}O$ Cyclohexane, 1,2-epoxy-, 571^a, 572^a, 2668^a.
- Cyclohexanone, 55^a, 230^a, 1216^a, 1407^a, 2464^a, 2667^a, 3052^a.
- Cyclopentanone, methyl-, 375^a, 900^a, 1635^a.
- Mesityl oxide, 387^a, 565^a.
- Δ^2 -2-Pentenone, 4-methyl-, 565^a.
- $C_6H_9O_2$ β -Butenic acid, α, β -dimethyl-, 227^a.
- Cyclobutanecarboxylic acid, 1799^a.
- Ethylene oxide, α, α' -ethylenebis-, 601^a.
- Hexanediol, 2117^a, 3188^a.
- Δ^2 -1-Hexenol, 5,6-epoxy-, 601^a.
- 2,3-Pentanedione, 4-methyl-(?), 892^a.
- Pentenic acid, β -methyl-, 1636^a.
- Δ^2 -2-Pentenone, 3-hydroxy-4-methyl-(?), 892^a.
- Δ^2 -1 Propenol, 2-methyl-, acetate, 2457^a.
- $C_6H_9O_3S_4$ Formic acid, dithiobis[thiono-, di-ethyl ester, P 23^a.
- Xanthogen, bisethyl-, P 1093^a.
- $C_6H_9O_3S_4$ Formic acid, trithiobis[thiono-, 890^a.
- $C_6H_9O_3S_4$ Formic acid, tetrathiobis[thiono-, di-Et ester, 890^a.
- $C_6H_9O_3$ (See also "ethyl ester" under *Acetoacetic acid*.)
- Anhydridigitoxose, 3618^a.
- 5-m-Dioxanone, 2,2-dimethyl-, 1798^a.
- $C_6H_9O_4$ Adipic acid, 258^a, 3890^a.
- Arabinol, 3190^a.
- 1,1-Ethanediol, diacetate, P 2274^a.
- Glycol, diacetate, 1961^a.
- Oxalic acid, di-Et ester, 1094^a, 1261^a.
- Succinic acid, dimethyl ester, 1216^a, 1398^a.
- $C_6H_9O_3S$ Propionic acid, β, β' -thiobis-, 1261^a.
- $C_6H_9O_3S_2$ Formic acid, trithiobis-, di-Et ester, 890^a.
- $C_6H_9O_3S_4$ Formic acid, tetrathiobis-, di-Et ester, 890^a.
- $C_6H_9O_3$ Lactic anhydride, 3189^a.
- ($C_6H_9O_3$)_n See *Celulose*; *Inulin*; *Starch*.
- $C_6H_9O_3S$ Propionic acid, α, α' -sulfonylbis-, 1964^a.
- $C_6H_9O_7$ (See also *Glucuronic acid*.)
- Galacturonic acid, 2001^a, 3603^a.
- Gluconic acid, keto-, and salts, 2460^a, 23^a.
- $C_6H_9O_8$ Mannosaccharic acid, 3892^a.
- Mucic acid, 429^a.
- Saccharic acid, 429^a, 2715^a.
- $C_6H_9S_4$ Oxalic acid, tetrathio-, di-Et ester, 3609^a.
- $C_6H_9S_2$ Formic acid, thiobis[dithio-, di-Et ester, 890^a.
- $C_6H_9S_4$ Formic acid, dithiobis[dithio-, di-Et ester, 890^a.
- $C_6H_9S_7$ Formic acid, trithiobis[dithio-, di-Et ester, 890^a.
- $C_6H_9S_8$ Formic acid, tetrathiobis[dithio-, di-Et ester, 890^a.
- $C_6H_9BO_3$ Addn. compd. of H_2BO_3 and citric acid, 1070^a.
- C_6H_9Br Cyclohexane, bromo-, 2672^a.
- $C_6H_9BrO_2$ Butyric acid, α -bromo- β, β -dimethyl-, 1966^a.
- $C_6H_9ClO_2$ 2-Pentanone, 3(and 4)-chloro-4(and 3)-hydroxy-4-methyl-, 892^a.

- C₆H₁₁Cl₂N** Isobutyrimidyl chloride, α -chloro-*N*-ethyl-, 1446².
C₆H₁₁Cl₂NO Butyramide, α , α -dichloro-*N*-ethyl-, 2875⁹.
C₆H₁₁Cl₂O 1-Pentanol, 1-(trichloromethyl)-, 1025⁹.
C₆H₁₁IOS 1,4-Thiopyrone, tetrahydro-, methiodide, 1262³.
C₆H₁₁N Capronitrile, 3530².
C₆H₁₁NO Cyclobutaneacetamide, 1799².
 Morphopyrrolidine, and -HCl, 413¹.
C₆H₁₁NO₄ Aspartic acid, mono-Et ester, 1798⁴, 2462².
C₆H₁₁NO₅ Glucononitrile, 1632¹.
C₆H₁₁N₃ *s*-Triazole, 3,5-diethyl, and salts, 3200⁹, 3201¹.
C₆H₁₁N₃O Urea, (α -cyano-*sec*-butyl)-, 1795¹.
 Urea, α -(α -cyanoisopropyl)- α -methyl-, 1795².
C₆H₁₁N₃S Carbazic acid, β -(allylthiocarbamyl)-dithio-, Me ester, 3200¹.
C₆H₁₂ (See also *Cyclohexane*.)
 2-Butene, 2,3-dimethyl-, 3887².
 Hexene, 730⁸, 889⁹, 1735⁵.
C₆H₁₂Al₂O₁₂ + 3H₂O Ammonium aluminum oxalate, 1416⁷.
C₆H₁₂BiN₂O₅S Acetamide, α -mercapto-, Bi deriv., 1631¹.
C₆H₁₂BrClO₂ Formaldehyde, β -bromo- β' -chloroisopropyl ethyl acetal, 223³.
C₆H₁₂BrNO Isobutyramide, α -bromo-*N*-ethyl-, 1446¹.
C₆H₁₂Br₂ Hexane, dibromo-, 889⁹, 1964⁸.
C₆H₁₂Br₂CoN₄ Addn. compd. of CoBr₂ and hexamethylenetetramine, 2623².
C₆H₁₂Br₂O Ether, β , γ -dibromobutyl ethyl, 890⁴.
C₆H₁₂ClIO₂ Formaldehyde, β -chloro- β' -iodoisopropyl ethyl acetal, 223³.
C₆H₁₂ClNO Butane, 2-chloro-3,3-dimethyl-2-nitroso-, 2872⁹.
 Hexane, chloronitroso-, 2872⁹.
 Isobutyramide, α -chloro-*N*-ethyl-, 1416².
 Pentane, 2-chloro-4-methyl-2-nitroso-, 2872⁹.
C₆H₁₂ClNO₂ Butane, 2-chloro-3,3-dimethyl-2-nitro-, 2872⁹.
 Hexane, chloronitro-, 3872⁹, 3873¹.
 Pentane, 2-chloro-4-methyl-2-nitro-, 2872⁹.
C₆H₁₂Cl₂CoN₄ Addn. compd. of CoCl₂ and hexamethylenetetramine, 2623².
C₆H₁₂Cl₂Ni Addn. compd. of NiCl₂ and hexamethylenetetramine, 2623².
C₆H₁₂Cl₂NiO₅ Pyruvohydroxamic acid, oxime, NiCl₂ compd., 1097².
C₆H₁₂Cl₂O₂ Formaldehyde, β , β' -dichloroisopropyl ethyl acetal, 223³.
C₆H₁₂Cl₂O₃S 1,2-Propanediol, 3-chloro-, 1,1'-sulfate, 567².
C₆H₁₂N₂ Butyronitrile, α -amino- α -ethyl-, and -HCl, 1795¹.
 Butyronitrile, γ -dimethylamino-, 2270⁹.
 Isobutyronitrile, α -(ethylamino)-, -HCl, 1795¹.
C₆H₁₂N₂O₃S Propionamide, β , β' -thiois-, 1262¹.
C₆H₁₂N₂O₄ Alanine, *N*-alanyl-, 567², 925⁷.
 Alanine, *N*-sarcosyl-, 1004.
 Allophanic acid, α , γ -dimethyl-, Et ester, 1633².
 Glycine, *N*-(*N*-methylalanyl)-, 1004.
C₆H₁₂N₂O₄ Butyric acid, γ -glycylamino- β -hydroxy-, 62².
C₆H₁₂N₂O₅S See *Cystine*.
C₆H₁₂N₂O₅V + 8H₂O Ammonium vanadyl malonate, 2230⁷.
C₆H₁₂N₂O₅Sb Acetamide, α -mercapto-, Sb deriv., 1631¹.
C₆H₁₂N₄ See *Hexamethylenetetramine*.
C₆H₁₂N₄IO₁₀S Pyruvohydroxamic acid, oxime, NiSO₄ compd., 1097².
C₆H₁₂N₄O₄ 2(3)-Imidazolone, 4,5-dihydro-4,5-dihydroxy-1-methyl-5-(α -methyl-carbamido)-(?), 3352⁹.
C₆H₁₂N₄S Isomelamine, trimethyl-, 899⁴.
C₆H₁₂O (See also *Cyclohexanol*.)
 Cyclopropanecarbinol, α , α -dimethyl-, 2666⁴.
 Ether, Δ^2 -butenyl ethyl, 890².
 —, ethyl α -methylallyl-, 890².
 Δ^1 -3-Hexenol, 564⁹, 731⁴.
 3-Pentanone, 2-methyl-, 892².
C₆H₁₂O₂ Acetic acid, *tert*-Bu ester, 387².
 Butyric acid, Et ester, 1453².
 Caproic acid, 13⁷, 38².
 1,2-Cyclohexanediol, 572².
 Formic acid, isoamyl ester, 55⁷.
 Isobutyric acid, Et ester, 55⁷.
 Isovaleric acid, α -methyl-, 54².
 2-Pentanone, 4-hydroxy-4-methyl-, 688⁹, 892².
 Valeric acid, α -methyl-, 54².
C₆H₁₂O₃S Caproic acid, α -mercapto-, 3045⁹.
 Paraldehyde, monothio-, 2872⁹.
C₆H₁₂O₃ See *Metaldhyde*; *Paraldehyde*.
C₆H₁₂O₄ Diglucose, 3618⁹.
C₆H₁₂O₄S Paraldehyde, monothio-, sulfone, 2872⁹.
C₆H₁₂O₅ (See also *Rhamnose*.)
 Glucosides, 1994⁴.
C₆H₁₂O₅S Caproic acid, α -sulfo-, Ba salt, 3045⁹.
 d -Glucose, 3-thio-, 1634⁴.
C₆H₁₂O₆ (See also *Fructose*; *Galactose*; *d*-Glucose; *Mannose*.)
 Acid from carminic acid, and salts, 1127².
 Glucose, 191², 1306².
 Inositol, 1796⁴.
C₆H₁₂O₇ Galactonic acid, 3353⁹.
 Gluconic acid, 435⁹, 2490¹, 3212², 3353⁹.
 Ca salt, 1967², 2009⁹.
 Mannonic acid, 3353⁹, 3892¹.
 Talonc acid, 898³.
C₆H₁₂Se₂ 2-Propanone, 2-seleno-, dimer, 1963².
C₆H₁₃BrClN β -Chloroallyltrimethylammonium bromide, 53².
C₆H₁₃Cl Pentane, 2-chloro-4-methyl-, 2658².
C₆H₁₃N Hexamethylenimine, and -HCl, 3186².
 2-Pipecoline, 583².
C₆H₁₃NO Acetamide, *N*-butyl-, 895⁴.
 2-Butanone, 4-dimethylamino-, 1121².
 3-Hexanone, oxime, 2873¹.
 Isobutyramide, *N*-ethyl-, 1446¹.
C₆H₁₃NO₂ (See also *Iledonal*; *Leucine*.)
 Alanine, *N*-ethyl-, methyl ester, 2870⁹.
 Butyric acid, α -amino- β , β -dimethyl-, 1966², 2250⁷.
 —, α -amino-, ethyl ester, and -HCl, 2876⁷.
 —, β -ethylamino-, and -HCl, 2876⁷.
C₆H₁₃NO₃ Glucosamine, 372⁹, 1969⁹.
 Glucosimine, 1969⁹.
C₆H₁₃N₂ Galegine, 3088⁴.
C₆H₁₃N₂O₂ Büret, 1-ethyl-3,5-dimethyl-, 1633².
C₆H₁₃N₂O₃P Fructose-6-phosphoric acid, 924².
 Glucosephosphoric acid, 3633².
C₆H₁₄ (See also *Hexane*.)
 Butane, 2,3-dimethyl-, 1576⁴, 3496⁸.
C₆H₁₄N₂ 1,2-Cyclohexanediamine, di-HCl, 590².
 Hydrazine, cyclohexyl-, and salts, 1802¹.
C₆H₁₄N₂O₂ See *Lysine*.
C₆H₁₄N₂O₃ 2,3-Butanediamine, oxalate, 2120¹.
C₆H₁₄N₂O₃ (See also *Arginine*.)
 Guanidine, α -amyl- γ -nitro-, 3348⁹.
 —, α -isoamyl- γ -nitro-, 3348⁹.

- $C_6H_{14}O$ Ether, amyl methyl, 1970⁸, 3046⁷.
 2-Hexanol, 730⁸, 3887⁸.
 Hexyl alcohol, 3551⁸, 3887⁸.
 Isohexyl alcohol, 3887⁸.
 • Pentanol, methyl-, 3887⁸.
 Propyl ether, 3298⁸.
 $C_6H_{14}O_2$ Acetal, 55⁸.
 1-Butanol, 4-ethoxy-, 731⁸.
 Hexanediol, 1964⁷, 3188⁸.
 Propanol, propoxy-, 1796⁸.
 $C_6H_4O_4$ Digitoxitol, 3619¹.
 $C_6H_4O_8$ (See also *Mannitol*; *Sorbitol*.)
 Dulcitol, 693¹.
 $C_6H_4O_12P_2$ Hexosephosphoric acid, di-, 1306⁸, 2462⁸, 3064⁸.
 $C_6H_5AlO_3$ See *Aluminum ethoxide*.
 C_6H_5As Arsine, triethyl-, 3612⁴.
 $C_6H_5AuS_6$, 3495⁹.
 C_6H_5ClIN (β -Chloroethyl)ethyl dimethylammonium iodide, 2660⁸.
 C_6H_5ClPb Plumbane, chlorotriethyl-, 1445².
 C_6H_5N Dipropylamine, 2659⁸.
 Isobutylamine, *N*, *N*-dimethyl-, 2660⁷.
 Triethylamine, 3147³.
 C_6H_5NO 1-Butanol, 3-amino-2,2-dimethyl-, 3347².
 $C_6H_5NO_2$ Ethanol, β diethylamino-, *N*-oxide, and chloroplatinate, 2249¹.
 Ethanol, 2-(β -dimethylaminoethoxy)-, -*HCl*, 3889⁸.
 $C_6H_5N_3$ Guanidine, α isoamyl-, and salt-, 62⁹.
 C_6H_5P Phosphine, triethyl-, 1632⁸, 2132².
 C_6H_5RbZn Rubidium ethyl, $ZnEt_2$ compd., 892².
 $C_6H_5CuN_6Se_2$, 3167².
 C_6H_5INO Ethyl(β hydroxyethyl)dimethylammonium iodide, 2660⁸.
 $C_6H_5N_2$ Putrescine, dimethyl-, and chloroplatinate, 1964⁸, *di-HCl*, 230⁷.
 $C_6H_5N_4$ Guanidine, aminoamyl-, 772⁸, 2320⁷.
 C_6H_5OPb Triethyllead hydroxide, 1445².
 $C_6H_5ClIN_2$ (β -Methylaminoethyl)trimethylammonium chloride, 2159⁷.
 C_6H_5NO Diethyl dimethylammonium hydroxide, 2660².
 $C_6H_5N_{12}NiO_4 + 2H_2O$ Guanidinium nickel biuret, 866⁸.
 $C_6H_5FeCl_3N_2$ Trimethylammonium pentachloroferrate, 711⁸.
 $C_6H_5Li_2N_6Ni$ Bistriaminopropanenickelous iodide, 388⁸.
 $C_6H_5N_6NiO_8S$ Bistriaminopropanenickelous sulfate, 388⁸.
 $C_6H_5Br_2CrF_{12}O_6$, 1235⁴.
 $C_6H_5Br_2CoO_6$ Addn. compd. of $CoBr_2$ and $MeOH$, 1235¹.
 $C_6H_5Br_2CrN_6 + 3.5H_2O$, 3572⁴.
 $C_6H_5Br_3CuN_6$ Bis(triaminopropanemono-hydrobromide) cupric bromide, *dihydrate*, 389¹.
 $C_6H_5CdCl_2N_6Pt$, 1417².
 $C_6H_5Cl_2CoO_6$ Addn. compd. of $CoCl_2$ and $MeOH$, 1235¹.
 • $C_6H_5Cl_3CrN_6 + 3.5H_2O$, 3572⁴.
 $C_6H_5Cl_3CuN_6Pt$, 1417².
 $C_6H_5Cl_3NiPt$, 1417².
 $C_6H_5Cl_3N_6PtZn$, 1417².
 $C_6H_5Cl_3N_6Pt_3$ Tetrachloro(triaminopropane monohydrochloride)platinum chloroplatinate, *monohydrate*, 389¹.
 $C_6H_5CrLiN_6 + 3.5H_2O$, 3572⁴.
 $C_6H_5CuN_6O_2$, 3167².
 $C_6H_5Li_2IrN_6 + H_2O$ Triethylenediamine iridi-iodide, 3571¹.
 $C_6H_5NO_8S_2Zn$, 1418¹.
 $C_6H_5N_6NiO_8S_2$, 1417².
 $C_6H_5N_6O_8SZn$, 1417².
 $C_6K_2N_6O_8$ 2,2'-Biimidazole, 1,5,1',5'-tetra-nitro-, di-K deriv., 3364⁸.
 $C_6K_2MnN_6$ Potassium manganicyanide, 1063⁹.
 C_6MnO_{12} , 540¹.
 $C_6La_2O_{12}$ Lanthanum oxalate, 1939².
 $C_6N_6Na_2O_8$ 2,2'-Biimidazole, 1,5,1',5'-tetra-nitro-, di-Na deriv., 3364⁸.
 $C_6Nd_2O_{12}$ Neodymium oxalate, 1939².
 $C_6O_8Sm_2$ Samarium oxalate, 1939².
 $C_6HCl_2NO_8S$ 3,4-Benzisothiazole-dione, 5,6-dichloro-, 2692⁸.
 $C_6HN_2Na_2O_8$ β -Resorcylnitrile, 3,5-dinitro-, di-Na deriv., 3363⁸.
 $C_6H_2AgClIN_2O_8$ Benzaldehyde, 2,4 (and 6)-chloro-3-hydroxy-4,6,2,6 (and 2,4)-di-nitro-, Ag deriv., 377⁸.
 $C_6H_2AgCl_2NO_8$ Benzaldehyde, 2,4 (and 2,6)-dichloro-3-hydroxy-6 (and 4)-nitro-, Ag deriv., 377⁸.
 $C_6H_2BrNO_8S$ 3,4-Benzisothiazole-dione, 5-bromo-, 2692⁸.
 $C_6H_2Cl_2N_2O_8$ 4,5-Benzimidazole-dione, 6,7-dichloro-, and -*HN*₂, 2691⁸.
 6,7-Isoindazole-dione, 4,5 dichloro-, 2693⁷.
 $C_6H_2Cl_3NO_8$ 4,6,7(5)-Isoindazole-trione, 5,5-dichloro-, 2693⁷.
 $C_6H_2Cl_4NO_8S$ 4-Benzisothiazolol, 3,5,6-trichloro-, 2692⁸.
 $C_6H_2Cl_4NS$ Isothiocyanic acid, trichlorophenyl ester, 904¹.
 $C_6H_2Cl_4NO_8S$ 4(3)-Benzisothiazolone, 3,3,5,5,6-pentachloro-5,6-dihydro-, 2692⁸.
 $C_6H_2Cl_5O_2P$ Phosphosul, 3,5-dichloro-, chloride, 3056⁸.
 $C_6H_2Cl_6O_2P$ Orthophosphosul, 3,5-dichloro-, chloride, 3056⁸.
 $C_6H_2I_3NO_8$ Benzoic acid, 2,3,4-triiodo-6-nitro-, 911¹.
 $C_6H_2N_2O_8$ 4,5,6,7-Isoindazole-tetrone, 2693⁷.
 $C_6H_2AgClINO_8$ Benzaldehyde, chloro-3-hydroxy-nitro-, Ag deriv., 377⁸.
 $C_6H_2AsClNO_8$ Benzoxazolone, arsinosochloro-, P 2961⁸, P 3105².
 $C_6H_2BrCl_2IO_8$ Anisole, 3-bromo-5-chloro-2,4,6-triiodo-, 574⁸.
 $C_6H_2BrCl_3NO_8S$ 4-Benzisothiazolol, 5-bromo-3-chloro-, 2692⁸.
 $C_6H_2BrCl_3NO_8$ Anisole, 3-bromo-5-chloro-2,4,6-trinitro-, 574⁸.
 $C_6H_2BrCl_3NO_8S$ Anisole, 3-bromo-2,4,6-trichloro-5-nitro-, 3606⁸.
 $C_6H_2BrCl_4IO_8$ Anisole, 3-bromo-2,4,5,6-tetra-chloro-, 574⁸.
 $C_6H_2BrN_6O_8S$ 4-Benzisothiazolol, 5-bromo-3-nitro-, 2692⁸.
 $C_6H_2Br_2Cl_2IO_8$ Anisole, 3,5-dibromo-2 (and 4)-chloro-4,6 (and 2,6)-diiodo-, 574⁸.
 $C_6H_2Br_2Cl_3NO_8S$ Anisole, dibromochlorodinitro-, 574⁸.
 $C_6H_2Br_2Cl_4O_8$ *p*-Toluquinone, 3,5-dibromo-6-chloro-, 3606⁸.
 $C_6H_2Br_2Cl_5IO_8$ Anisole, 3,5-dibromo-2,4 (and 2,6)-dichloro-6 (and 4)-iodo-, 574⁸.
 $C_6H_2Br_2Cl_6NO_8S$ Anisole, 3,5-dibromo-2,4 (and 2,6)-dichloro-6 (and 4)-nitro-, 574⁸.
 $C_6H_2Br_2Cl_7O_8$ Anisole, 3,5-dibromo-2,4,6-trichloro-, 574⁸.
 $C_6H_2Br_3IO_8$ *p*-Toluquinone, 3,5-dibromo-6-iodo-, 3606⁷.
 $C_6H_2Br_4NO_8S$ 4-Benzisothiazolol, 3,5-dibromo-, 2692⁸.

- C₇H₅Br₂NS** Isothiocyanic acid, 2,5-dibromo-phenyl ester, 16377.
C₇H₅Br₂N₂O Salicylyl azide, 3,5-dibromo-, 1120².
C₇H₅Br₂ClNO₂ Anisole, tribromochloronitro-, 574², 3606².
C₇H₅Br₂Cl₂O Anisole, tribromodichloro-, 574², 3606².
C₇H₅Br₂O₂ *p*-Toluquinone, tribromo-, 14527, 3606².
C₇H₅Br₂ClO Anisole, tetrabromochloro-, 574².
C₇H₅ClN₂O₂S Benzothiazole, 4-chloro-1-mercapto-7-nitro-, 26891.
C₇H₅ClN₂O₂ 4,7-Benzimidazole-dione, 6-chloro-5-hydroxy-, 2691².
 4,7-Isindazole-dione, 5-chloro-6-hydroxy-, 26937.
C₇H₅ClN₂O Benzoyl chloride, 3,5-dinitro-, 372.
C₇H₅ClN₂O Benzaldehyde, 2(4 and 6)-chloro-3-hydroxy-4,6(2,6 and 2,4)-dinitro-, 3777².
C₇H₅Cl₂IO Anisole, 3,6-dichloro-2,4,6-triiodo-, 3606².
C₇H₅Cl₂N Benzonitrile, 2,4-dichloro-, 1327.
C₇H₅Cl₂NOS 4-Benzisothiazolol, 3,5-dichloro-, 2692².
C₇H₅Cl₂NO Benzaldehyde, dichlorohydroxy-nitro-, 3777², P 30581.
C₇H₅Cl₂NS Isothiocyanic acid, 2,3-dichloro-phenyl ester, 9041.
C₇H₅Cl₂N₂O 6-Isindazolol, 4,5,7-trichloro-, 26937.
C₇H₅Cl₂NO Anisole, 2,3,4,6-tetrachloro-5-nitro-, 3606².
C₇H₅HgNO Benzoic acid, 2-(hydroxymercuri)-3-nitro-, anhydride, 3896².
C₇H₅N₂O Quinolinic anhydride, P 918².
C₇H₅N₂O 5-Benzisoxazolol, 4,6-dinitro-, 3363².
C₇H₅N₂O 5-Benzisoxazolol, 4,6-dinitro-, 3363².
C₇H₅N₂O Benzoic acid, 2,4,6-trinitro-, 6517, 7401.
C₇H₅AsNO Benzoxazolone, arsinoso-, P 2961², P 3105².
C₇H₅BrClN₂O Anisole, 5-bromo-3-chloro-2,4-dinitro-, 574².
C₇H₅BrClN₂O Phenol, 3-bromo-5-chloro-4-methoxy-2,6-dinitro-, 36057.
C₇H₅BrClO Benzaldehyde, bromochloro-, 12547².
C₇H₅BrCl₂O Anisole, 3-bromo-2,4,6-trichloro-, 3606².
C₇H₅BrIO Benzaldehyde, bromoiodo-, 1254².
C₇H₅BrIO Benzoic acid, bromoiodo-, 1254².
C₇H₅BrN Benzonitrile, bromo-, 777².
C₇H₅BrNOS 4-Benzisothiazolol, 3-bromo-, and -II Br, 2692².
C₇H₅BrNO Benzoic acid, 2-bromo-3-nitro-, 3898².
C₇H₅BrNS Isothiocyanic acid, *o*-bromophenyl ester, 16377.
C₇H₅BrN₂O Indazole, 3-bromonitro-, 1119², 1120².
C₇H₅Br₂ClO *o*-Cresol, 3,5-dibromo-4-chloro-6-iodo-, 3606².
C₇H₅Br₂ClNO Anisole, dibromochloronitro-, 3606².
C₇H₅Br₂Cl₂O Anisole, 3,5-dibromo-2,4(and 2,6)-dichloro-, 574².
o-Cresol, 3,5-dibromo-4,6-dichloro-, 3606².
C₇H₅Br₂IO *o*-Cresol, 3,5-dibromo-4,6-diiodo-, 36067.
C₇H₅Br₂N₂O Cresol, dibromodinitro-, 72², 36067.
C₇H₅Br₂N₂S Aniline, 2,6-dibromo-4-thiocyano-, 1638².
- C₇H₅Br₂O** Benzaldehyde, 3,4-dibromo-, 1254².
C₇H₅BrClO Anisole, tribromochloro-, 574², 3606².
o-Cresol, tribromochloro-, 36067².
C₇H₅BrCl₂O Phenol, 2,4,6-tribromo-3-chloro-5-methoxy-, 575².
C₇H₅BrIO *o*-Cresol, 3,4,5-tribromo-6-iodo-, 36067.
C₇H₅BrIO Phenol, 2,4,6-tribromo-3-iodo-5-methoxy-, 575².
C₇H₅BrNO Anisole, tribromonitro-, 72², 36061.
m-Cresol, 2,4,6-tribromo-5-nitro-, 72².
C₇H₅Br₂O *o*-Cresol, tetrabromo-, 1407².
C₇H₅Br₂O Phenol, 2,3,4,6-tetrabromo-5-methoxy-, 575².
C₇H₅ClFO₂S Benzoyl chloride, *m*(and *p*)-(fluoro-sulfonyl)-, 3604².
C₇H₅ClIO Benzaldehyde, chloroiodo-, 1254².
C₇H₅ClNO Benzoic acid, 3(and 4)-chloro-4(and 3)-iodo-, 1254².
C₇H₅Cl₂O Anisole, 3-chloro-2,4,6-triiodo-, 574².
C₇H₅ClN Benzonitrile, chloro-, 777², 1327.
C₇H₅ClNOS 4-Benzisothiazolol, 3-chloro-, 2692².
C₇H₅ClNO Benzoyl chloride, nitro-, 2125², 2897², 3887².
C₇H₅ClNO Benzaldehyde, chloro-3-hydroxy-nitro-, 3777², P 30581.
C₇H₅ClNS Benzothiazole, chloromercapto-, 2688², 26891.
C₇H₅ClN₂O Indazole, 3-chloro-4(5 and 6)-nitro-, 1119².
C₇H₅ClN₂O Benzaldehyde, 2-chloro-3-hydroxy-4,6-dinitro-, oxime, 3777.
C₇H₅Cl₂P Metaphosphosal, chloride, 30567.
C₇H₅Cl₂N₂O 5-Benzimidazolol, 4,6-dichloro-, 2691².
C₇H₅Cl₂N₂O 4,5-Benzimidazole-diol, 6,7-dichloro-, 2691².
C₇H₅Cl₂N₂O Benzaldehyde, 2,6-dichloro-3-hydroxy-4-nitro-, oxime, 3777.
C₇H₅Cl₂O Benzaldehyde, 2,6-dichloro-3-hydroxy-, P 30581.
C₇H₅Cl₂O₂S Salicylic acid, bis(chlorosulfonyl)-, 72².
C₇H₅Cl₂O Anisole, 2,3,4,6-tetrachloro-, 3606².
C₇H₅Cl₂P Orthophosphosal, chloride, 3056².
C₇H₅FNO₂S Benzenesulfonyl fluoride, *m*-cyano-, 3604².
C₇H₅HgO Benzoic acid, *o*-(hydroxymercuri)-, anhydride, 3896².
C₇H₅IN Benzonitrile, *p*-iodo-, 777.
C₇H₅INS Isothiocyanic acid, *o*(and *m*)-iodo-phenyl ester, 16377.
C₇H₅IN₂O Indazole, 3-iodo-6-nitro-, 1119².
C₇H₅IN₂O Benzoic acid, 3-amino-2,4-diiodo-6-nitro-, 911.
C₇H₅IO Benzaldehyde, 3,4-diiodo-, 1254².
C₇H₅IO *β*-Resorcylic acid, 3,5-diiodo-, 2671².
C₇H₅IO Toluene, 2,3,4-triiodo-6-nitro-, 90².
C₇H₅NNaO₂S Crystallose, 2857.
C₇H₅N₂O Benzonitrile, *p*-nitro-, 1327.
C₇H₅N₂O₂S Benzothiazole, 1-mercapto-5-nitro-, 26891².
C₇H₅N₂O Benzisoxazole, 4-nitro-, 92².
C₇H₅N₂O₂S 4-Benzisothiazolol, 3-nitro-, 2692².
C₇H₅N₂O 5-Benzisoxazolol, 4-nitro-, 3363².
 4,7-Isindazole-dione, 5,6-dihydroxy-, 2693².
β-Resorcylnitrile, 5-nitro-, 3363².
C₇H₅N₂O₂TI Thallium *m*-cresoxide, 2,4,6-trinitro-, 2878².
C₇H₅N₂O 1,2,3-Benzotriazole-5-carboxylic acid, 7-nitro-, 1813².
C₇H₅N₂O Aniline, *N*-methyl-*N*,2,3,4,6-penta-nitro-, 2671².

- C₇H₅O₂PbS** Benzoic acid, *o*-mercapto-, cyclic Pb salt, 12577.
C₇H₅O₂ 2-Furanpropionic acid, 2896^a.
C₇H₅AgN₂ Indazole, Ag deriv., 3893^a.
C₇H₅AgO₂ α,γ -Pentadienic acid, β , δ , δ -tri-hydroxy-, δ -lactone, acetate, Ag deriv., 17987.
C₇H₅AsClNO₂ 4-Benzoxazolearsonic acid, 6-chloro-, P 3371^a.
C₇H₅AsClNO₂ Benzoxazolinearsonic acid, chloro-keto-, P 2962¹, P 3105¹.
C₇H₅BrClHO Anisole, 4-bromo-2-chloro-6-iodo-, 36057.
C₇H₅BrClNO Benzaldehyde, bromochloro-, oxime, 12547^a.
C₇H₅BrINO Benzaldehyde, bromoiodo-, oxime, 1254^a.
C₇H₅BrN₂O₂ Benzaldehyde, 4-bromo-3-nitro-, oxime, 12547.
C₇H₅BrO₂ α,γ -Pentadienic acid, α -bromo- β , δ , δ -tri-hydroxy-, δ -lactone, acetate, 1798^a.
C₇H₅Br₂ClN₂S Benzothiazole, 1-amino-5-chloro-, dibromide, 2688².
C₇H₅Br₂ClO Anisole, dibromochloro-, 574^a, 7^a, 3606^a.
C₇H₅Br₂ClO *o*-Cresol, 3,5-dibromo-4-chloro-, 36067.
C₇H₅Br₂NO Benzaldehyde, 3,4-dibromo-, oxime, 1254^a.
C₇H₅Br₂NO₂ Salicylaldehyde, 3,5-dibromo-, oxime, 921.
C₇H₅Br₂NO₂ Toluene, α,α -dibromo- α -nitro-, 73^a.
C₇H₅Br₂O Anisole, 2,4,5-tribromo-, 36061.
C₇H₅Br₂O₂ 2-Furanpropionic acid, α,β ,5 tri-bromo-, 2895^a.
C₇H₅Br₂N₂S Benzothiazole, 1-amino-5-bromo-, tetrabromide, 2688^a.
C₇H₅Br₂ClN₂S Benzothiazole, 1-amino-5 chloro-, hexabromide, 2688².
C₇H₅ClHgO₂ Benzoic acid, *p*-(chloromercuri)-, 38967.
C₇H₅ClINO Benzaldehyde, chloroiodo-, oxime, 1254^a.
C₇H₅ClI₂O Anisole, 2-chloro-4,6-diiodo-, 3606^a.
C₇H₅ClN₂ Indazole, 4-chloro-, 1119^a.
C₇H₅ClN₂OS Benzothiodiazole, 6-chloro-5-methoxy-, 2690^a.
C₇H₅ClN₂O₂ Benzaldehyde, 4-chloro-3-nitro-, oxime, 12547.
C₇H₅ClN₂O₂ Benzaldehyde, 2-chloro-3-hydroxy-4 (and 6)-nitro-, oxime, 377^a, 5.
C₇H₅ClN₂S Benzothiazole, 1-amino-5-chloro-, 2688².
C₇H₅ClN₂S Benzothiazole, ?-amino-4-chloro-1-mercapto-, 26891.
C₇H₅ClO See *Benzoyl chloride*.
C₇H₅ClO₂ Benzaldehyde, chlorohydroxy-, P 3058¹, 31897.
C₇H₅ClO₂ Salicylaldehyde, 4-chloro-, 31987.
C₇H₅ClO₂ Benzoic acid, chlorohydroxy-, 570^a, 3189^a.
C₇H₅ClS 1,3-Benzodithiylum chloride, and *ZnCl₂ compd.*, 72^a, 73¹.
C₇H₅Cl₂IO Anisole, dichloroiodo-, 2883^a.
C₇H₅Cl₂NO Benzaldehyde, 3,4-dichloro-, oxime, 12547.
C₇H₅Cl₂NO Benzohydroxamyl chloride, *o*-chloro-, 11071.
C₇H₅Cl₂NO₂ Toluene, 2,4-dichloro-5-nitro-, 19711.
C₇H₅Cl₃ Toluene, α -trichloro-, 1581^a.
C₇H₅Cl₃N₂O₂ 6,6,7(7)-Indazoletriol, 4,5,7-trichloro-, 2693^a.
C₇H₅Cl₃N₂S Urea, thio (3,4,6-trichlorophenyl)-, 9041.
C₇H₅Cl₃O Anisole, 2,4,6-trichloro-, 3606^a.
C₇H₅FO Benzaldehyde, fluoro-, 235^a.
C₇H₅FO₂S Benzoic acid, (fluorosulfonyl)-, and *NH₄ salt*, 3604^a, 5.
C₇H₅FO₂S Salicylic acid, 5-(fluorosulfonyl)-, and *NH₄ salt*, 3605^a.
C₇H₅INO₂ Benzaldehyde, 4-iodo-3-nitro-, oxime, 12547.
C₇H₅IO₂ Benzoic acid, *p*-iodo-, 3898^a.
C₇H₅IO₂ β -Resorcylic acid, 5-iodo-, 2671^a.
C₇H₅I₂NO Benzaldehyde, 3,4-diiodo-, oxime, 1254^a.
C₇H₅MnO₂, 540^a.
C₇H₅N See *Benzonitrile*.
C₇H₅NO Benzisoxazole, 921, 3363^a.
C₇H₅NO Isocyanic acid, Ph ester, 587².
C₇H₅NO₂ 4-Benzisothiazolol, 2692^a.
C₇H₅NO₂ Benzisoxazolol, 11207, 3363^a.
C₇H₅NO₂ 1-Benzoxazolone, 11207.
C₇H₅NO₂ β -Resorcylnitrile, 3363^a.
C₇H₅NO₂ See *Benzaldehyde, nitro-*.
C₇H₅NO₂S See *Saccharin*.
C₇H₅NO₂S 4-Benzothiazolesulfonic acid, 1-mercapto-, salts, 2688^a.
C₇H₅NO₂ Benzoic acid, nitro-, 850^a, 1805^a, 3047^a, 3296^a.
C₇H₅NO₂ Salicylic acid, 5-nitro-, 11087.
C₇H₅NS Isothiocyanic acid, Ph ester, 97^a, 587².
C₇H₅NS Benzothiazole, mercapto-, 92^a, P 2479¹, 26887.
C₇H₅N₂O Benzoyl azide, 3463^a.
C₇H₅N₂O₂ Salicyl azide, 736^a.
C₇H₅N₂O₂S Benzothiazole, 1-amino-3-nitro-, 2688^a.
C₇H₅N₂O₂ See *Toluene, trinitro-*.
C₇H₅N₂O₂ Guaiacol, 3,4,6-trinitro-, 376^a.
C₇H₅N₂O₂ Tetrayl, 823^a.
C₇H₅NaO₂ See *Sodium benzoate*.
C₇H₅NaO₂ See *Sodium salicylate*.
C₇H₅AsNO₂ 4-Benzoxazolearsonic acid, P 3371^a.
C₇H₅AsNO₂ Benzoxazolinearsonic acid, chloro-, 7761.
C₇H₅BrCl Toluene, bromochloro-, 54^a, 24661^a.
C₇H₅BrClO Anisole, bromochloro-, 574^a, 3605^a.
C₇H₅BrFO₂S *m*-Toluenesulfonyl fluoride, 6-bromo-6-hydroxy-, 3605^a.
C₇H₅BrNO Benzamide, *m*-bromo-, 2689².
C₇H₅Br₂N *p*-Toluidine, 2,6-dibromo-3-iodo-, 2671^a.
C₇H₅Br₂N₂S (Urea, (2,5-dibromophenyl)thio-, 1637^a.
C₇H₅Br₂O Phenol, 2,6 dibromo-3-methoxy-, 236^a.
C₇H₅Br₂O₂ 2-Furanpropionic acid, α,β -dibromo-, dibromide, 2895^a.
C₇H₅ClHgNO₂ Toluene, (chloromercuri)nitro-, 1105^a, 5.
C₇H₅ClIO Anisole, 4-chloro-2-iodo-, 2883^a.
C₇H₅ClINO₂ Salicylaldehyde, 4-chloro-, oxime, 3189^a.
C₇H₅ClNO₂ Toluene, α -chloro-*o*(*m* and *p*)-nitro-, 2255^a, 4.
C₇H₅ClNO₂S *o*-Toluenesulfonyl chloride, *o*(*m* and *p*)-nitro-, 2254^a.
C₇H₅ClNO₂S *m*-Toluenesulfonyl chloride, 6-hydroxy-5-nitro-, 3897².
C₇H₅ClNO₂S *m*-Toluenesulfonic acid, 4-chloro-5-nitro-, *Na salt*, 573^a.
C₇H₅ClN₂ Benzimidazole, 5-amino-4-chloro-, 2691^a.
C₇H₅ClN₂ 1,3,4-Imidazopyridine, 5(or 7)-chloro-2-methyl-, 1986^a.
C₇H₅ClN₂ Indazole, 6-amino-7-chloro-, 2693^a.
C₇H₅Cl₂ Toluene, dichloro-, 54^a, 1454¹, 1581^a, 2129^a.

- C₇H₅Cl₂Hg₂O *o*-Cresol, 4, 6-bis(chloromercuri)-, 1253².
- C₇H₅Cl₂O₂S *o*-Toluenesulfonyl chloride, 4-chloro-, 739⁴.
- C₇H₅Cl₂O₂S₂ *m*-Benzenedisulfonyl chloride, 2-hydroxy-5-methyl-, 3897⁴.
- C₇H₅FNO Benzaldehyde, fluoro-, oxime, 235⁴.
- C₇H₅FNO₂S Benzenesulfonyl fluoride, *m*(and *p*)-carbonyl-, 3604⁵.
- C₇H₅FNO₂S 1-Phenol-4-sulfonyl fluoride, 2-formamido-, 3605².
- Toluenesulfonyl fluoride, nitro-, 3604⁴, ⁵.
- C₇H₅FNO₂S Benzenesulfonyl fluoride, 4-methoxy-3-nitro-, 3605⁴.
- Toluenesulfonyl fluoride, hydroxynitro-, 3605⁴, ⁵.
- C₇H₅F₂O₂S₂ *m*-Benzenedisulfonyl fluoride, 4-methyl-, 3604⁴.
- C₇H₅Hg₂O₂S *o*-Cresol, 4, 6-bis(hydroxymercuri)-, cyclic sulfate, 1253².
- C₇H₅INO₂ Anisole, iodinitro-, 1974¹, ².
- C₇H₅I₂N₂O₂ *m*-Toluidine, 2, 6-diiodo-4-nitro-, 90².
- C₇H₅I₂N Toluidine, triiodo-, 91¹, 2671⁸.
- C₇H₅NNaO₂ Guaiacol, 3-nitro-, Na deriv., 376⁷.
- C₇H₅N₂O Benzisoxazole, 4-amino-, 3363⁷.
- 1, 4-Imidazopyridin-2(3)-one, 1263⁸, 1264⁸.
- Salicylonitrile, 5-amino-, 3363⁷.
- C₇H₅N₂O₂ 1(2)-Pyridineglyoxylic acid, 2-imino-, 1264⁴.
- C₇H₅N₂O₂ See *Toluene, dinitro-*.
- C₇H₅N₂O₂ Anisole, dinitro-, 2675⁷, 3894⁴.
- Cresol, dinitro-, 1970², 2163⁸, ⁹.
- C₇H₅N₂O₂ Guaiacol, dinitro-, 376⁷, ⁹.
- C₇H₅N₂O₂S Phenol, 2-(methylsulfonyl)-4, 6-dinitro-, 905⁸.
- C₇H₅N₂S Aniline, *p*-thiocyano-, 1638¹.
- Benzisothiazole, 4-amino-, 2692⁸.
- C₇H₅N₂S Benzothiazole, 4(and 5)-amino-1-mercapto-, 2688⁸, 2689¹.
- C₇H₅N₂O Anthranol azide, 2697⁷.
- Benzoyl azide, *p*-amino-, 2697⁷.
- C₇H₅N₂O₂ 1, 2, 3-Benzotriazole-5-carboxylic acid, 7-amino-, 1813⁹.
- 1, 2, 3-Benzotriazole, 5-methyl-7-nitro-, 1813⁹.
- C₇H₅O See *Benzaldehyde*.
- C₇H₅OS Benzoic acid, thiono-, salts, 2458⁸.
- C₇H₅OS₂ Benzoic acid, seleno-, and *NH₄* salt, 1104³.
- C₇H₅O₂ (See also *Benzoic acid; Salicylaldehyde*.)
- 2-Furanacrolein, 3053⁸.
- p*-Toluquinone, 1452⁷.
- C₇H₅O₂S Benzoic acid, *o*-mercapto-, cyclic Pb salt, 1257⁷.
- C₇H₅O₂ (See also *Benzoic acid, hydroxy-; Salicylic acid*.)
- 2-Furanacrylic acid, 2895⁷.
- Perbenzoic acid, 2877⁹.
- β -Resorcylaldehyde, 378⁸.
- C₇H₅O₂ Gallic acid, 1105¹, 3251⁷.
- Glutaric acid, α -(α -hydroxyethylidene)- β -keto-, lactone, Cu salt, 2462⁴.
- α , γ -Pentadienic acid, α -acetyl- β , δ , δ -tri-hydroxy-, δ -lactone, 1798¹.
- α , γ -Pentadienic acid, β , δ , δ -tri-hydroxy-, δ -lactone, monoacetate, 1796⁷.
- C₇H₅O₂S Benzoic acid, *o*-sulfo-, salts, 78⁴.
- C₇H₅O₂S Salicylic acid, sulfo-, 2430⁸.
- C₇H₅S₂ Benzoic acid, dithio-, 3609².
- C₇H₅BF₄M₂ Toluenediazonium fluoroborate, 1070³, 2668⁴.
- C₇H₅BO₂ Addn. compd. of H₂BO₂ and meconic acid, 1070³.
- C₇H₅BrIN *p*-Toluidine, 2-bromo-5-iodo-, 2671⁸.
- C₇H₅BrN₂S Urea, (*o*-bromophenyl)thio-, 1637⁸.
- C₇H₅BrO Anisole, bromo-, 1106¹, 3189⁴.
- C₇H₅BrO₂ Phenol, bromomethoxy-, 236², 575², 1253⁸, ⁹.
- C₇H₅BrS Sulfide, (*o* and *p*)-(bromophenyl)methyl, 1106¹.
- C₇H₅Cl See *Toluene, chloro-*.
- C₇H₅ClHgO *o*-Cresol, 4(and 6)-(chloromercuri)-, 1253¹, ².
- C₇H₅ClMg Benzylmagnesium chloride, 1108¹.
- C₇H₅ClNNaO₂S See *Chloramine-T*.
- C₇H₅ClN₂ 1, 2, 3-Benzotriazole, 5-amino-4-chloro-1-methyl-, 2690¹.
- C₇H₅ClN₂O₂ Δ^4 (7)-Isouric acid, 4-chloro-3, 9-dimethyl-, 3352².
- C₇H₅ClO Anisole, *o*-chloro-, 3189⁹.
- C₇H₅ClO₂ Phenol, 3-chloro-5-methoxy-, 575¹.
- C₇H₅ClO₂S Toluenesulfonyl chloride, P 1207⁹, 1978⁸.
- C₇H₅ClO₂Succinic anhydride, α -(α -chloroethylidene)- β -methyl-, 386¹.
- C₇H₅ClO₂S *o*-Toluenesulfonic acid, 4-chloro-, K salt, 739⁴.
- C₇H₅ClNO₂S See *Dichloramine-T*.
- C₇H₅Cl₂N₂O Compd., m. 106.5°, from Cl₂CHO and 2 aminopyridine, 94⁸.
- C₇H₅F Toluene, *p*-fluoro-, 2668⁴.
- C₇H₅FO₂S Toluenesulfonyl fluoride, 3604⁴, ⁵.
- C₇H₅FO₂S Benzenesulfonyl fluoride, *p*-methoxy-, 3605⁴.
- Toluenesulfonyl fluoride, hydroxy-, 3605⁴, ⁵.
- C₇H₅FO₂S *m*-Toluenesulfonic acid, 5-(fluorosulfonyl)-6-hydroxy-, and salts, 3605⁴.
- C₇H₅HgNO₂ Benzoic acid, 4(and 5)-amino-3(and 2)-(hydroxymercuri)-, 70⁸, ⁹.
- C₇H₅HgNO₂ *o*-Cresol, 4(and 6)-(hydroxymercuri)-, nitrate, 1253².
- C₇H₅IN₂O₂ *m*-Toluidine, 6-iodo-4-nitro-, and *HCl*, 90².
- C₇H₅IN₂S Urea, (iodophenyl)thio-, 1637⁸.
- C₇H₅IO Anisole, *o*-iodo-, 3189⁴.
- C₇H₅IO₂ Phenol, 3-iodo-5-methoxy-, 575².
- C₇H₅I₂N *p*-Toluidine, 2, 5-diiodo-, 2671⁸.
- C₇H₅I₂N₂ *p*-Aminidine, 3, 5-diiodo-, and salts, 91².
- C₇H₅KN₂O₂ Δ^4 -Isouric acid, 7, 9-dimethyl-, K deriv., 3353².
- C₇H₅KO See *Potassium cresoxide*.
- C₇H₅N Benzalimine, 2257⁹.
- C₇H₅NO (See also *Benzamide*.)
- Anhydro-*p*-amino-*o*-hydroxybenzyl alcohol, 1449⁹.
- Anthranilaldehyde, 1641⁴.
- Benzaldehyde, oxime, 75⁴.
- Formanilide, 1678⁸, P 2273⁴, 2670¹.
- C₇H₅NO₂ (See also *Anthranilic acid; Benzoic acid, amino-; Toluene nitro-*.)
- Benzohydroxamic acid, 1097⁸, ⁹.
- Carbanilic acid, 1678⁸.
- C₇H₅NO₂S Sulfide, methyl (*o* and *p*)-nitrophenyl, 1106¹.
- C₇H₅NO₂ Anisole, nitro-, 690¹, 1106¹, 3611¹, ⁸.
- Furan, (β -nitropropenyl)-, 2895⁴.
- 3-Pyrrolecarboxylic acid, 5-formyl-2-methyl-, 381¹.
- C₇H₅NO₂ Guaiacol, 3-nitro-, 376⁷.
- Maleic anhydride, α -propionylamino-, 60⁹.
- C₇H₅NO₂S Benzoic acid, *m*-sulfamyl-, 78⁴.
- Toluenesulfonic acid, nitro-, and Na salt, 1105⁷, ⁸.
- C₇H₅NO₂S Phenol, 2-(methylsulfonyl)-4-nitro-, 905⁸.

- Toluenesulfonic acid, nitro-, 2254¹; *K* salt, 1105².
- $C_7H_7NO_3S$ *m*-Toluenesulfonic acid, 6-hydroxy-5-nitro-, and salts, 3897^{2,3}.
- $C_7H_7N_3$ Carbazonitrile, α -phenyl-, 913².
- 1,3,4-Imidazopyridine, 2-methyl-, 1986⁶.
- $C_7H_7N_3O_2$ Benzaldehyde, 4-amino-3-nitro-, oxime, 1254⁸.
- $C_7H_7N_3O_4$ 1,3,5,7(2,6,7a)-Isoimidazimidazole tetrone, 2,6-dimethyl-, 3353².
- $C_7H_7N_3O_5S_2$ 5-Nitro-4-sulfo-*o*-toluenediazonium sulfate, 1105².
- $C_7H_7N_3NaO_3$ Δ^2 -Isouric acid, 7,9-dimethyl-, Na deriv., 3353⁴.
- $C_7H_7O_4P$ *o*-Phenylene methyl phosphate, 2461⁶, 3056⁶.
- C_7H_8 See *Toluene*.
- $C_7H_8AuNO_3S_2$ Sulfanilic acid, *N*-(hydroxymethyl)-2-mercapto-, *S*-gold deriv., *Na* sulfite, Na salt, 2759².
- C_7H_8BrN Benzylamine, bromo-, and -HCl, 53²; salts, 2669².
- C_7H_8BrNO Acetanilide, *p*-bromo-, 1678⁹.
- C_7H_8ClN Benzylamine, *m*-chloro-, and -HCl, 541¹.
- $C_7H_8ClNO_2S$ *o*-Toluenesulfonamide, 4-chloro-, 739⁴.
- $C_7H_8Cl_2N_2O$ Hydrazine, 2,3-dichloro-*p*-anisyl-, -HCl, 2690⁹.
- $C_7H_8Cl_2N_4O_2$ Uric acid, 4,5-dichloro-4,5 dihydro-3,9-dimethyl-, 3352⁵.
- $C_7H_8FNO_3S$ Toluenesulfonyl fluoride, amino-, 3604^{4,6}.
- $C_7H_8FNO_4S$ Metanilyl fluoride, 4-methoxy-, and -HCl, 3605⁴.
- m*-Toluenesulfonyl fluoride, 4-amino-6-hydroxy-, and -HCl, 3605².
- C_7H_8Hg Methyl phenyl mercury, 233⁶.
- $C_7H_8N_2O$ Benzohydroxamamide, 75^{2,3}.
- $C_7H_8N_2O_2$ Benzylamine, nitro-, 78².
- Hydroxylamine, β -nitroso- β -*p*-tolyl-, 904².
- Salicylic acid, hydrazide, 736⁶.
- $C_7H_8N_2O_2$ Glycine, *N*-1-pyrrolyl-, 1648⁹.
- Hydroxylamine, α -*p*-nitrobenzyl-, and -HCl, 2257².
- α -Maleimide, α -propionylamino-(?), 60⁹.
- Pyridine, 2-ethoxy-5-nitro-, 1814⁵.
- $C_7H_8N_2O_3S$ α -Toluenesulfonamide, *o*-(*m* and *p*)-nitro-, 2254⁸.
- $C_7H_8N_2O_4$ 3,5-Pyrazoledicarboxylic acid, 1-hydroxy-, di-Me ester, 3903⁹.
- $C_7H_8N_2O_5S$ *m*-Toluenesulfonamide, 6-hydroxy-5-nitro-, 3897².
- m*-Toluenesulfonic acid, 4-amino-6-nitro-, and salts, 1105².
- $C_7H_8N_4$ 1,2,3-Benzotriazole, 7-amino-5-methyl-, 1813⁸.
- $C_7H_8N_4O$ 3-Triazene-carboxamide, 1 phenyl-, 2003⁸.
- $C_7H_8N_4O_2$ See *Euphyllin*; *Theobromine*; *Theophylline*.
- $C_7H_8N_4O_3$ Isouric acid, dimethyl-, and salts, 3352^{2,4}, 3353^{4,6}.
- Uric acid, dimethyl-, 899⁸, 2824².
- $C_7H_8N_4O_4$ Δ^2 (?) -Isouric acid, 4-hydroxy-, 9-dimethyl-, 3352².
- $C_7H_8N_4S$ *o*-Phenylenethiocarbohydrazide, 213^{2,1}.
- C_7H_8O See *Anisole*; *Benzyl alcohol*; *Cresol*.
- $C_7H_8O_2$ (See also *Guaiacol*; *Saligenin*.)
- 4-Homopyrocatechol, 2886⁶.
- Phenol, *p*-methoxy-, 1253⁸.
- Δ^2 -1-Propenol, 3-(2-furyl)-, 3053⁷.
- Pyrone, dimethyl-, 360⁹, 3047².
- $C_7H_8O_2Se$ Tolueneseleninic acid, 1252⁴.
- $C_7H_8O_3$ Elsholtzie acid, methyl ester, 2896⁶.
- 2-Furaldehyde, 5-(methoxymethyl)-, 3182⁹.
- 2-Furancarbinol, acetate, 3903².
- Protocatechuy alcohol, 2886⁶.
- $C_7H_8O_3S$ Toluenesulfonic acid, 653⁷, P 1128¹.
- $C_7H_8O_4$ Aconic acid, 2,4-dimethyl-, and *NH_4* addn. compd., 385⁹.
- Compd., m. 175², from α (or β)-methoxyethylmethylmaleimide, 385².
- 2-Furancarboxylic acid, 5-(methoxymethyl)-, 3183¹.
- Muconic acid, β -methyl-, 60⁹.
- $C_7H_8O_5S_2$ Toluene, SO_2 addn. compd., 738².
- $C_7H_8O_6$ Glutaric acid, α acetyl β -keto-, and *Cu* salt, 2462².
- Glutaric anhydride, β , β -dihydroxy-, monoacetate, 1798⁷.
- $C_7H_8O_6S_2$ Toluene, SO_2 addn. compd., 738².
- $C_7H_8O_7S_2$ *m*-Benzenedisulfonic acid, 2-hydroxy-5-methyl-, and *Ag* salt, 3897⁴.
- C_7H_8S Sulfide, methyl phenyl, 1106¹, 2256¹.
- $C_7H_8AsN_2O_3$ See *Tryparsamide*.
- $C_7H_8AsN_2O_4$ Arsanilic acid, *N*-carbamyl-2-hydroxy-, 2695¹.
- $C_7H_8AsO_4$ *m*-Toluenearsonic acid, 4-hydroxy-, 3896².
- $C_7H_8AuN_2O_3S$ 4(or 5)-Imidazolecarboxylic acid, 2-(auromerapto)-5(or 4)-methyl-, Et ester, 3615¹.
- $C_7H_8BO_3$ Addn. compd. of H_2BO_3 and salicylic acid, 1070².
- $C_7H_8BrFNO_3S$ *m*-Toluenesulfonyl fluoride, 5-bromo-6-hydroxy-, NH_4 deriv., 3605².
- $C_7H_8BrO_2$ Sorbic acid, bromo-, Me ester, 2659².
- $C_7H_8BrO_3$ Methanetricarboxylic acid, bromo-, tri-Me ester, 238².
- $C_7H_8ClHgN_2O_3S$ 4(or 5)-Imidazolecarboxylic acid, 2-(chloromercurimerapto)-5(or 4)-methyl-, Et ester, 3615².
- $C_7H_8ClO_4$ Succinic acid, α -(α -chloroethylidene)- β -methyl-, and *NH_4* addn. compd., 385².
- C_7H_8N (See also *Aniline*, *N*-methyl-, *Benzylamine*; *Toluidine*.)
- Lutidine, 480⁹, 573².
- C_7H_8NO *Ag* midine, 107¹, 1106¹, P 3058², 3611²; - $IPSO_4$, 577².
- Benzyl alcohol, *p*-amino-, 3615⁴.
- $C_7H_8NO_2$ Anthranilic acid, 4,5-dihydro-, and *Cu* salt, 2468⁶.
- Guaiacol, 6-amino-, 370⁸.
- p*-Toluenesulfonamide, 1970².
- $C_7H_8NO_3S$ Methanesulfonic acid, anilino-, *Zn* salt, 3171².
- $C_7H_8NO_4$ 2-Furaldehyde, 5-(methoxymethyl)-, oxime, 3183¹.
- $C_7H_8NO_5S$ 1-Phenol-4-sulfonamide, *N*-methyl-, 3605¹.
- m*-Toluenesulfonamide, 6-hydroxy-, 3605².
- o*-Toluenesulfonic acid, 4-amino-, *NH_4* salt, 739⁴.
- $C_7H_8NO_6$ Fumaric acid, α -propionylamino-(?), mono-*NH_4* salt, 60⁹.
- Maleic acid, α -propionylamino-(?), mono-*NH_4* salt, 60⁹.
- C_7H_8NS Aniline, *o*(and *p*)-methylmercapto-, 1106¹.
- $C_7H_8N_2O$ Anthranilic acid, hydrazide, 2697².
- Benzoic acid, *p*-amino-, hydrazide, 2697².
- Pyridine, 2-acetamido-5-amino-, 1814⁵.
- Urea, (6-methoxy-3-pyridyl)-, 1814⁵.
- $C_7H_8N_2O_2$ 4-*o*-Tolylenediamine, 6-nitro-, 1813⁷.
- $C_7H_8N_2O_3$ Guanidine, α , γ -dipyrrolyl-, 2663².
- $C_7H_8N_2O_4$ 1-Imidazolecarboxamide, tetrahydro-

- 5-hydroxy-2,4-diketo-3-methyl-, acetate, 3353¹.
- C₇H₇N₂NaO₂ Uric acid, 4,5-dihydro-3,9-dimethyl-, Na deriv., 3353¹.
- C₇H₅O₄P Phosphoric acid, benzyl ester, salts, 2461^{1,2}.
- C₇H₅O₄P Phosphoric acid, o-anisyl ester, salts, 2461^{1,2}.
- C₇H₁₀BrNO₂ Malonic acid, bromonitro-, di-Et ester, 52¹.
- C₇H₁₀ClN₂O Pyrimidine, chloroethoxy(methyl-amino)-, 2271⁷.
- C₇H₁₀Cl₂O Cyclohexanecarboxyl chloride, 1-chloro-, 2875¹.
- C₇H₁₀FN₂O₂ Toluenesulfonyl fluoride, hydroxy-, NH₂ deriv., 3605^{2,4}.
- C₇H₁₀N₂ Pyrazole, allylmethyl-, 2890².
- Pyridine, 2-dimethylamino-, 247¹.
- Tolylethylenediamine, 128¹, 270¹.
- C₇H₁₀N₂O Morphopyrrolidine, N-cyano-, 412¹.
- C₇H₁₀N₂O₂S 4(or 5)-Imidazolecarboxylic acid, 2-(ethylmercapto)-5(or 4)-methyl-, and salts, 3614¹.
- C₇H₁₀N₂O₂ Hydantoin, 1-acetyl-5,5-dimethyl-, 1794¹.
- 4-Imidazolecarboxylic acid, 2,3-dihydro 2-keto-1,3-dimethyl-, Me ester, 3353¹.
- , 2,3-dihydro-2-keto-1,3,5-trimethyl-, and Ag salt, 3353¹.
- C₇H₁₀N₂O₄ Fumaramic acid, α-propionylamino-(?), 60¹.
- Maleamic acid, α-propionylamino-(?), 60¹.
- C₇H₁₀N₂O₄ Pyruvoyldioxamic acid, oxime, di-Ac deriv., 1097¹.
- C₇H₁₀N₂O₄ Desoxytheobromine, 3185¹.
- C₇H₁₀N₂O₂ Uric acid, 4,5-dihydro-3,9-dimethyl-, 3353¹.
- C₇H₁₀N₂O₂ 1-Imidazolecarboxamide, 3-ethyl-tetrahydro-2,4-diketo- N-methyl- N-nitro-, 3352¹.
- C₇H₁₀O₂ Furan, 2-(ethoxymethyl)-, 1648¹.
- 2-Furanpropanol, 3053¹.
- C₇H₁₀O₂ Adipic anhydride, β-methyl-, 1968¹.
- C₇H₁₀O₂ Malonic acid, isopropenylmethyl-, 227¹.
- Paraconic acid, 2-ethyl-, 2877¹.
- Terebic acid, 2877¹.
- C₇H₁₀O₂ Glyceraldehyde, diacetate, 797¹.
- 2-Propanone, 1,1-dihydroxy-, diacetate, 390¹.
- C₇H₁₁BaO₄P Barium glycerophosphate, diacetate, 1630¹.
- C₇H₁₁BrClN Diallylamine, bromochloro- N-methyl-, 534^{1,2}.
- C₇H₁₁BrN₂O₂ Asparagine, Nα-(α-bromopropionyl)-, 60¹.
- C₇H₁₁BrO₂ Cyclopentanecetic acid, α-bromo-, 50¹.
- C₇H₁₁BrO₄ Malonic acid, bromo-, di-Et ester, 3890¹.
- Malonic acid, bromo-*tert*-butyl-, 1966¹.
- C₇H₁₁Br₂N Diallylamine, dibromo- N-methyl-, and -HCl, 533^{1,2}.
- C₇H₁₁Br₂N₂O₂ 1,3,5,4-Oxidiazin-4-one, tetrahydro-3,5-dimethyl-2-methylene-6-methylimino-, perbromide, 2131¹.
- C₇H₁₁ClO₂ Cyclohexanecarboxylic acid, 1-chloro-, 2875¹.
- Cyclopentanecetyl chloride, 1-hydroxy-, 3186¹.
- C₇H₁₁Cl₂N Diallylamine, dichloro- N-methyl-, and -HCl, 534^{1,2}.
- C₇H₁₁Cl₂O₂ 1-Propanol, 2-methyl-1-(trichloromethyl)-, acetate, 1625¹.
- C₇H₁₁N Pyrrole, 2,3,4-trimethyl-, 85¹.
- Pyrrole, ethylmethyl-, 102¹, 103¹.
- C₇H₁₁NO₂ (See also *Arecoline*.)
- Δ²-Cyclohexanecarboxylic acid, 2-amino-, and salts, 2468¹.
- Glutarimide, β-ethyl-, 1968¹.
- , β,β-dimethyl-, 1968¹.
- Succinimide, α-ethyl-α-methyl-, 2877¹.
- C₇H₁₁NO₂ Senecioic acid, α-acetamido-, 1966¹.
- C₇H₁₁NO₂S 1-Ethylpyridinium sulfate, 95¹.
- C₇H₁₁N₂ 3,4,5-Toluenetriamine, 1813¹.
- C₇H₁₁N₂O Sorbaldehyde, semicarbazone, 895¹.
- C₇H₁₁N₂O₂ 1,3,5,4-Oxidiazin-4-one, tetrahydro-3,5-dimethyl-2-methylene-6-methylimino-, and *deris.*, 2130¹, 2131¹.
- C₇H₁₁N₂O₂ 1-Imidazolecarboxamide, 3-ethyltetrahydro-2,4-diketo- N-methyl-, 3352¹.
- 2,5-Piperazinedione, 1-alanyl-, 1966¹.
- C₇H₁₁N₂O₂ Hydrouracil, 5,6-dihydroxy-5-methoxy-1,3-dimethyl-, nitrite, 1447¹.
- C₇H₁₁N₂O₂ Δ²-Isouric acid, 7,9-dimethyl-, NH₂ deriv., 3353¹.
- C₇H₁₂ Cyclopentene, 1,2-dimethyl-, 375¹.
- C₇H₁₂Br₂N₂O Δ²-Pentenone, 3-bromo-4-methyl-, semicarbazone, 565¹.
- C₇H₁₂Br₂O₂ Valeric acid, α,δ-dibromo-, Et ester, 266¹.
- C₇H₁₂Cl₂N Chlorotetramethylpyrazolium iodide, 2897^{1,2}.
- C₇H₁₂CINO Cyclohexanecarboxamide, 1-chloro-, 2875¹.
- C₇H₁₂CINO₂ Lactimidic acid, β-chloro-, Et ester, acetate, -HCl, 388¹.
- C₇H₁₂N₂ Cyclohexanenitrile, 1-amino-, 1643¹.
- C₇H₁₂N₂O 2(3)-Imidazolone, 1,3-diethyl-, 3304¹.
- C₇H₁₂N₂O₂ Pseudothiohydantoin, 5-butyl-, 3045¹.
- C₇H₁₂N₂O₂ Hydantoin, 5,5-diethyl-, 2875¹.
- Hydantoin, 1-ethyl-5,5-dimethyl-, 1795¹.
- , 1,3,5,5-tetramethyl-, 1795¹.
- 2,5-Piperazinedione, 1,3,4-trimethyl-, 100¹.
- 2-Piperidine, 3-acetamido-, 390¹.
- C₇H₁₂N₂O₂S Acetic acid, (4,5-dihydro-2-imidazolylmercapto)-, Et ester, 245¹.
- C₇H₁₂N₂O₂ 2-Pyrrolidinedicarboxylic acid, 1-amino-5-keto-, ethyl ester, -HCl, 2897¹.
- C₇H₁₂N₂O₂ Urea, α,α'-methylenebis[β-acetylthio]-, 1101¹.
- C₇H₁₂N₂O₄ Urea, α,α'-methylenebis[β-acetyl-, 1101¹.
- C₇H₁₂O Cycloheptane, 1,2-epoxy-, 1448¹.
- Cyclohexanone, methyl-, 375¹, 1407¹, 2404¹, 2667¹.
- Cyclopentanone, dimethyl-, 570¹, 1635¹.
- Ether, Δ²-cyclohexenyl methyl, 588¹.
- Ethylene oxide, cyclopentyl-, 59¹.
- Ketone, cyclobutyl ethyl, 2463¹.
- Δ²-2-Pentenone, 3-ethyl-, 2249¹.
- C₇H₁₂O₂ Adipaldehyde, β-methyl-, 2889¹.
- Δ²-2-Butenol, 3-methyl-, acetate, 2457¹.
- Cyclobutanecarboxylic acid, Et ester, 1249¹.
- Formic acid, cyclohexyl ester, 1407¹.
- Pentenic acid, β-ethyl-, 1636¹.
- Δ²-1-Propanol, 3-(2,3,4,5-tetrahydro-2-furyl)-, 3053¹.
- C₇H₁₂O₂ Glutaric acid, dimethyl ester, 1216¹.
- Malonic acid, di-Et ester, 55¹.
- C₇H₁₂O₂ Valeric acid, γ,δ-dihydroxy-α,β-dimethoxy-, δ-lactone, 393¹.
- C₇H₁₂O₂ Glutaric acid, hydroxydimethoxy-, 392¹.
- C₇H₁₂Br 1-Heptene, bromo-, 2117¹, 2248¹.
- C₇H₁₂BrO Anisole, 2-bromohexahydro-, 52¹.
- Enanthaldehyde, α-bromo-, 1796¹, 3043¹, 3608¹.

- C₇H₁₃BrO₂ Valeric acid, δ -bromo-, Et ester, 2661⁵.
- C₇H₁₃Br₂ClN₄Sn, 213⁹.
- C₇H₁₃Cl 1-Heptene, 1-chloro-, 2117⁹.
- C₇H₁₃ClN₂O₂ Malonamide, *N*-chloro- α , α -diethyl-, 2875².
- C₇H₁₃ClO₃ Propionic acid, β -chloro- α -ethoxy-, Et ester, 388⁹.
- C₇H₁₃Cl₂O See *Dormiol*.
- C₇H₁₃FeNO₈S, 2232².
- C₇H₁₃NO Anisole, hexahydro-2-iodo-, 571⁷.
- C₇H₁₃NO Cyclopentanone, 2,5-dimethyl-, oxime, 570⁷.
- Δ^4 -2-Pentenone, 3-ethyl-, oxime, 2243⁹.
- 2-Pyrrolidone, 3,3,5-trimethyl-, 2472⁹.
- C₇H₁₃NO₂ Stachydrine, 24911.
- C₇H₁₃NO₂ Butyric acid, β -keto- α , α -dimethyl-, Me ester, oxime, 3347².
- Caproic acid, ϵ -formyl-, oxime, 2119⁸.
- Leucine, *N*-formyl-, 389⁷.
- C₇H₁₃N₂O Urea, (α -cyano- α -ethylpropyl)-, 1795¹.
- Urea, α -(α -cyanoisopropyl)- α -ethyl-, 1795³.
- C₇H₁₃N₂O₂S Acetoacetic acid, Et ester, thiosemicarbazone, 2128¹.
- C₇H₁₃N₂O₂ Acetoacetic acid, Et ester, semicarbazone, 2128².
- C₇H₁₃N₂O₃ Glycine, diglycyl-, Me ester, 1661⁶.
- Glycine, *N*-(*N*-sarcosylglycyl)-, 100⁴.
- α , α -Guanidinedicarboxylic acid, 899⁷.
- C₇H₁₃N₃ Pyrimidine, 2,4,6-tris(methylamino)-, and di-*HCl*, 2271⁸.
- C₇H₁₄ (See also *Cyclohexane, methyl-*)
- Cyclobutane, propyl-, 2163⁸.
- Cyclopentane, dimethyl-, 50⁸, 375⁸, 2660⁸.
- C₇H₁₄BrNO Isocaproamide, α -bromo-*N*-methyl-, 1657⁸.
- C₇H₁₄Br₂O₂ Propionaldehyde, α , α -dibromo-, di-Et acetal, 3608⁴.
- C₇H₁₄ClNO Acetamide, α -chloro-*N*-isoamyl-, 1657⁸.
- Heptane, chloronitroso-, 1107², 2872⁹.
- C₇H₁₄ClNO₂ Heptane, 4-chloro-4-nitro-, 2873¹.
- Propionimide acid, β -chloro- α -ethoxy-, Et ester, -*HCl*, 388⁹.
- C₇H₁₄ClN₂O₂ 2-Pentanone, 3-chloro-4-hydroxy-4-methyl-, semicarbazone, 892⁹.
- C₇H₁₄Hg Cyclohexyl methyl mercury, 233².
- C₇H₁₄N₂O₂ 2-Imidazolol, 1-ethyl-, 3-ethyl hydroxide, and isomer, 3364².
- C₇H₁₄N₂O₃ Alanine, *N*-glycyl-, Et ester, 2663⁸.
- Alanine, *N*-(*N*-methylalanyl)-, 100⁴.
- Urea, α , α -diethyl- β -hydroxy-, acetate, 570⁴.
- C₇H₁₄N₂O₄ *d*-Glucose, ureide, 1969⁹.
- C₇H₁₄N₂O Acetone, carbonylhydrazine, 1248⁹.
- C₇H₁₄N₂ Melamine, *N*, *N'*-diethyl-, 899².
- C₇H₁₄O (See also *Cyclohexanol, methyl-*; *Butyrene*.)
- Cyclopentanol, 1,2-dimethyl-, 375⁷.
- Cyclopropanecarbinol, α -ethyl- α -methyl-, 2860⁸.
- 2-Heptanone, 3888⁹.
- Enanthaldehyde, 2835².
- Δ^1 -3-Heptenol, 564⁸, 731³.
- Δ^2 -2-Hexenol, 2-methyl-, 732⁹.
- C₇H₁₄OS Acetic acid, thiono-, Am ester, 2458⁸.
- C₇H₁₄O₂ Acetic acid, Am ester, 7³, 149⁸, 2184⁷, 2596⁷; *tert*-Am ester, 1581¹; isoamyl ester, 55⁷, 1581¹, 2119⁸, 3889¹.
- Caproic acid, α -methyl-, 54⁸.
- Enanthaldehyde, α -hydroxy-, 3608⁸.
- Enanthic acid, 13⁷; *Na salt*, 235⁷.
- 2-Furanpropanol, tetrahydro-, 3053⁸.
- Isocaproic acid, α -methyl-, 54⁸.
- 2-Pentanol, acetate, 1581¹.
- 2-Pentanone, 3-ethyl-4-hydroxy-, 2249⁹.
- 2-Pentanone, 4-methoxy-4-methyl-, 892⁷.
- Valeric acid, Et ester, 1453⁹.
- C₇H₁₄O₂ Isobutyric acid, α -hydroxy-, Et ester, P 3057⁸.
- Isopropyl carbonate, 1729².
- Propyl carbonate, 1729².
- Valeric acid, α -hydroxy-, Et ester, P 3057⁸.
- C₇H₁₄O₃ Arabinose, 2,4-dimethyl-*d*-, 393³.
- Arabinose, ethyl-, 114⁸.
- C₇H₁₄O₃S *d*-Glucose, 3-methylthio-, 1634⁴.
- C₇H₁₄O₆ (See also *Hexoxide, methyl-*)
- Glucose, 6-methyl-, 393³.
- Glucoside, methyl-, 392¹, 747⁹.
- Mannoside, α -methyl-, 3891⁷.
- Mytilitol, 281⁹.
- C₇H₁₄O₇ Glucoheptose, 1633³.
- C₇H₁₄AuCl₂N₂O γ -Cyano- γ -(hydroxypropyl)trimethylammonium chloroaurate, 1631⁹.
- C₇H₁₄BrO₂ 2,4-Hexanediol, 3-bromo-2-methyl-, 733¹.
- Propionaldehyde, α -bromo-, di-Et acetal, 3608⁴.
- C₇H₁₄ClN₂O γ -Cyano- γ -(hydroxypropyl)trimethylammonium chloride, 1631⁹.
- C₇H₁₄ClO₂ 2-Butanol, 1-(β -chloroethoxy)-2-methyl-, 3889⁷.
- 2,4-Hexanediol, 3-chloro-2-methyl-, 733¹.
- 2-Propanol, 1-butoxy-3-chloro-, 567².
- Propionaldehyde, β -chloro-, di-Et acetal, 1631⁸.
- C₇H₁₄NO Acetamide, *N*-isoamyl-, 895⁸.
- 2-Butanone, 4-dimethylamino-3-methyl-, and chloroaurate, 1121⁵.
- Butyrene, oxime, *ZnCl₂ addn. compd.*, 3346⁷.
- 1-Piperidineethanol, and -*HCl*, 1977⁸.
- C₇H₁₄NO₂ Alanine, *N*-ethyl-, ethyl ester, and -*HCl*, 2876⁸.
- C₇H₁₄NO₃ (See also *Carnitine*.)
- Butyric acid, γ -dimethylaminohydroxy-, Me ester, betaine, 1631⁷, 3892².
- Valeric acid, α -amino- β -ethoxy-, 898⁹.
- C₇H₁₄NPb Plumbane, cyanotriethyl-, 1445¹.
- C₇H₁₄N₃ Guanidine, α -allyl- γ -ethyl- β -methyl-, β -H₂NO₄, 1463⁹.
- C₇H₁₄N₃O Semicarbazide, 1-cyclohexyl-, 1802².
- C₇H₁₄O₃P Formic acid, phosphono-, tri-Et ester, 1627⁸.
- C₇H₁₆ See *Heptane*.
- C₇H₁₆BrN Propylamine, γ -bromo-*N*,*N*-diethyl-, and -*HBr*, 3355⁸.
- C₇H₁₆Hg Butyl propyl mercury, 233².
- C₇H₁₆IN₃ 2,4(1,3)- ϵ -Triazinone, dihydro-3-methyl-2,4-dithio-, trimethiodide, 1101².
- C₇H₁₆N₂ Pyrrolidine, 1-(γ -aminopropyl)-, and chloroaurate, 565⁸.
- C₇H₁₆N₂O Acetamide, α -amino-*N*-isoamyl-, and -*HCl*, 1657⁸.
- Isocaproamide, α -amino-*N*-methyl-, 1657⁸.
- C₇H₁₆O 4-Heptanol, 3887⁸.
- Heptyl alcohol, 1678⁹, 3887⁸.
- Hexanol, methyl-, 3887⁸.
- C₇H₁₆O₂ 1,4-Heptanediol, 3053⁸.
- 2,4-Hexanediol, 2-methyl-, 732⁹.
- 2-Pentanol, 5-ethoxy-, 731³.
- C₇H₁₇NO 1-Propanol, 2-diethylamino-, 60⁸.
- C₇H₁₇NO₂ See *Choline, acetyl-*.
- C₇H₁₇IN Ethyldimethylpropylammonium iodide, 2660⁸.
- C₇H₁₇NO Ethyldimethylpropylammonium hydroxide, 2660⁸.

- C₇H₁₉N₃ See *Spermidine*.
 C₇Cs Cesium carbide, 1583¹.
 C₇H₂Cd₂K₂O₁₆ + 2H₂O, 3327⁷.
 C₇H₂Cl₄O₂ Phthalic acid, tetrachloro-, 3047⁶.
 C₇H₂Cl₃N₂O₃ 4 - Benzothiodiazolol, 3,5,6-trichloro-, acetate, 2690⁷.
 C₇H₂NO₂ Phthalic anhydride, 3-nitro-, 3899³.
 C₇H₂ClN₂O₂ 1 - Isoindazolecarboxyl chloride, 6-nitro-, 1120².
 C₇H₂Cl₂N₂ Naphthyridine, 2,4 - dichloro-, and chloroaurate, 1649².
 C₇H₂Cl₂N₂O₂ 4,5 - Benzimidazoleione, 6,7-dichloro-2-methyl-, 2691⁹.
 C₇H₂Cl₂O₂ Phthalyl chloride, 3192³.
 C₇H₂Cl₂N₂O₂ 5,6 - Benzimidazoleione, 4,4,7,7-tetrachloro - 4,7 - dihydro - 2 - methyl-, -HCl, 2691⁹.
 C₇H₂Cl₂O₂ 4,4' - Bi[1,3 - dioxolane] - 5,5'-dione, 2,2' - bis(trichloromethyl)-, 1962⁷ ⁸.
 C₇H₂N₂O₂ Pseudoisatin, 6-nitro-, 912⁴.
 C₇H₂N₂S Benzoxazole, *m*(and *p*) - isothiocyano-, 1637⁷.
 C₇H₂N₂S, *m* - α - Benzobisthiazole, 2,6 - dimercapto, 2688⁹.
 C₇H₂O₂S₂ 1,4 - Benzodithiin - 2,3 - dione, 73¹.
 C₇H₂O₂ See *Phthalic anhydride*.
 C₇H₂AgN₂O₂ 1,2,4 - Oxidiazol - 3 - ol, 5 - phenyl-, Ag deriv., 1976⁴.
 C₇H₂BrN₂O₂ 1,2,4 - Oxidiazole, 3 - bromo - 5-phenyl-, 1977¹.
 C₇H₂BrN₂O₂ α - Tolunitrile, α - bromo - α - nitro-, 73⁸.
 C₇H₂BrN₂O₂ Styrene, 4 - bromo - β ,2(and β ,3)-dinitro-, 399⁷ ⁸.
 C₇H₂BrN₂O₂ Vanillonitrile, dibromo-, 2258⁵, 3898³.
 C₇H₂Br₂N₂S Isothiocyanic acid, 3,5-dibromo-*o*-tolyl ester, 1637⁷.
 C₇H₂Br₂N₂S Benzothiazole, 1-amino-5-cyano-, tetrabromide, 2688¹.
 C₇H₂Br₂N₂S Benzothiazole, 1-amino-5-cyano-, hexabromide, 2688¹.
 C₇H₂ClN₂O Benzohydroxamyl chloride, *p*-cyano-, 1107³.
 1,2,4-Oxidiazole, 3-chloro-5-phenyl-, 1976⁹.
 C₇H₂ClN₂O₂ 4,7 - Benzimidazoleione, 6 - chloro-5-hydroxy-2-methyl-, 2691⁹.
 C₇H₂ClN₂O₂ Styrene, 4 - chloro - β ,2(and β ,3)-dinitro-, 399⁷.
 C₇H₂ClN₂O₂ Piperonylohydroxamyl chloride, 6-nitro-, 1107².
 C₇H₂ClN₂O₂ Benzoyl chloride, methoxydinitro-, 2675⁷ ⁸.
 C₇H₂ClO₂ Benzoyl chloride, 2,3-methylene-dioxy-, 588³.
 C₇H₂Cl₂N₂O₂ Acetophenone, 3,4-dichloro-2-nitro-, 3621⁹.
 C₇H₂Cl₂N₂O Benzimidazole, 4,6 - dichloro - 5-formamido-, 2691⁴.
 C₇H₂Cl₂N₂O₂ Acetanilide, 3,5 - dichloro - 2,4-dinitro-, 3606⁴.
 C₇H₂Cl₂N₂ Acetimidyl chloride, α -trichloro-*N*-phenyl-, 2875³.
 C₇H₂NO₂ Benzene, 1 - ethynyl - 2 - nitro-, 2127¹.
 Benzonitrile, 2,3 - methylenedioxy-, 588³.
 Isatin, 2126⁹, 2432⁷.
 Isatol, 1117⁵.
 Phthalimide, 2877⁷.
 C₇H₂NO₂S₂ 4 - Benzothiazolecarboxylic acid, 1-mercapto-, 2688⁹.
 C₇H₂NO₂ Benzofurandione, oxime, 1678⁷, 1269⁴.
 1,3,2 - Benzoxazine - 2,4(3) - dione, 1269⁴.
 Pseudoisatin, 1-hydroxy-, 2127¹, 2897⁵.
 C₇H₂NO₂ 2(1)-Benzofuranone, 4-nitro-, 1117⁷.
 C₇H₂NO₂ Piperonal, 6-nitro-, 3608³.
 C₇H₂NO₂S 5 - Pseudoindolesulfonic acid, 2-hydroxy-3-keto-, 2126⁹.
 C₇H₂NO₂ Phthalic acid, 3-nitro-, 3899⁴.
 C₇H₂N₂NaO₂ 1,2,4 - Oxidiazol - 3 - ol, 5 - phenyl-, Na deriv., 1976⁴.
 C₇H₂N₂ Malononitrile, (2 - pyrrolylmethylene)-, 3817⁷.
 C₇H₂N₂O₂ Acetophenone, α -diazo-*o*-nitro-, 2897⁷.
 C₇H₂N₂O₂ α - Tolunitrile, 2,4 - dinitro-, 1267⁵.
 C₇H₂N₂S Benzothiazole, 1 - amino - 5 - cyano-, 2688¹.
 C₇H₂N₂ Pyridylmelanurenic acid, 2694³.
 C₇H₂ Benzene, ethynyl-, 1804³, P 2534⁴.
 C₇H₂AsNO₂ Benzoxazolone, arvinosomethyl-, P 2961¹, P 3105².
 C₇H₂BaO₄U₂ Barium uranatomalate, 713⁴.
 C₇H₂BrClN₂O₂ Benzene, 1 - bromo - 3 - chloro-2,5 - dimethoxy - 4,6 - dinitro-, 3605⁷.
 C₇H₂BrClN₂ Acetimidyl chloride, α -bromo- α -chloro-*N*-phenyl-, 2876².
 C₇H₂BrNO₂ Acetophenone, α -bromo-*o*-nitro-, 2897⁷.
 Glyoxylohydroxamic acid, (*p*-bromophenyl)-, and Na salt, 742⁹.
 C₇H₂Br₂ClO Anisole, 3,5 - dibromo - 4 - chloro-2-iodo-6-methyl-, 3606³.
 C₇H₂Br₂ClNO Acetanilide, α , α - dibromo - α -chloro-, 2659⁵.
 C₇H₂Br₂Cl₂O Anisole, 3,5 - dibromo - 2,4 - dichloro-6-methyl-, 3606⁷.
 C₇H₂Br₂Cl₂O Anisole, 3,5 - dibromo - 2,4 - di-iodo-6-methyl-, 3606⁷.
 C₇H₂Br₂N₂O₂ Anisole, dibromomethyldinitro-, 72³, 3606⁷.
 C₇H₂Br₂O₂ *m* - Xyloquinone, 3,5 - dibromo-, 1452².
 C₇H₂Br₂O Vanillin, dibromo-, 2258⁵, 3898⁸.
 C₇H₂Br₂ClO Anisole, 3,4,5 - tribromo - 2 - chloro-6-methyl-, 3606⁷.
 C₇H₂Br₂ClO₂ Benzene, 1,2,4 - tribromo - 5-chloro-3,6-dimethoxy-, 574⁴.
 C₇H₂Br₂IO Anisole, 3,4,5 - tribromo - 2 - iodo-6-methyl-, 3606⁷.
 C₇H₂Br₂NO₂ Anisole, 2,4,6 - tribromo - 3-methyl - 5 - nitro -, 72³.
 C₇H₂Br₂O₂ Benzene, 1,2,4,5 - tetrabromo-3,6-dimethoxy-, 574⁴.
 Veratrole, 3,4,5,6 - tetrabromo-, 1640⁹.
 C₇H₂ClN₂ Tolunitrile, chloro-, 132⁷, 1454¹.
 C₇H₂ClNO₂ Acetophenone, chloronitro-, 2125¹, 2898¹.
 Benzoic acid, *p* - (chloroformyl)-, oxime, 1107³.
 Nitrilidin, chloro, 2125².
 Piperonylohydroxamyl chloride, 1107¹.
 Toluene, α - chloro - 3,4 - methylenedioxy- α -nitroso-, 1107².
 C₇H₂OHNO₂ Acetic acid, chloro-, *p*-nitrophenyl ester, 1117⁷.
 Acetophenone, 2 - hydroxy - 5 - nitro-, 1117⁷.
 Benzaldehyde, 2 - chloro - 3 - methoxy - 4 (and 6)-nitro-, 377⁴ ⁵.
 C₇H₂CINS Benzothiazole, 4-chloro-1-methyl-, 975⁵.
 C₇H₂CINS Benzothiazole, 4 - chloro - 1 - mercapto - 5' - methyl-, 2689³.
 C₇H₂CINO Benzimidazole, 4 (and 6) - chloro - 5-formamido-, 2691⁴.

- C₈H₇ClN₂O₂** Benzimidazole, 2-chloro-1-methyl-nitro-, 383^{1,2}.
- C₈H₇ClN₂O₄** Benzaldehyde, 2(4 and 6) - chloro-3 - hydroxy - 4,6(2,6 and 2,4) - dinitro-, semicarbazone, 377³.
- C₈H₇ClN₂O** 5 - Benzimidazoleol, 4,6 - dichloro-2-methyl-, -HCl, 269¹.
- C₈H₇Cl₂N₂O₂** Benzimidazoleol, dichloro-methyl-, 269¹; and -HCl, 269¹.
- Terephthalohydroxymethyl chloride**, 1107².
- C₈H₇Cl₂N₂O₄** Benzaldehyde, 2,4(and 2,6)-dichloro - 3 - hydroxy - 6(and 4) - nitro-, semicarbazone, 377³.
- C₈H₇Cl₂O** Acetophenone, 2,4(and 3,4)dichloro-, 3621^{5,9}.
- C₈H₇Cl₂N** Acetimidyl chloride, α , α -dichloro-*N*-phenyl-, 287⁵.
- C₈H₇Cl₃NO** Acetimidic acid, α - trichloro-, Ph ester, -HCl, 1256⁹.
- C₈H₇Cl₃NO₂** Acetic acid, trichloro-, 2,4-dichloroaniline salt, 1630².
- C₈H₇INO** Oxidole, iodo-, P 301⁸.
- C₈H₇INO** Acetophenone, α -iodo-*o*-nitro-, 2808¹.
- C₈H₇INO₄** Phenol, iodonitro-, acetate, 1974^{1,2}.
- C₈H₇N₂** Naphthyridine, and *chloroaurate*, 3203^{7,8}.
- Pyridopyridine**, P 3425⁴; and salts, 2470^{8,9}, 2471¹.
- Quinoxaline**, 743⁴.
- C₈H₇N₂O₄** 4,5 - Benzohept - 1,2,6 - oxadiazine, 7-hydroxy-, 1119⁶.
- 2,4 - Naphthyridinediol, 1649¹.
- Oxadiazolol, phenyl-, 239⁶, 733¹.
- Phthalazinedione, dihydro-, 1329¹, 2676⁸.
- 1(2) - Phthalazone, 4 - hydroxy-, 2676⁹.
- Phthalimide, *N* amino-, 2676^{8,9}.
- Pseudoisatin, oxime, 912².
- α -Tolunitrile, nitro-, 1327.
- C₈H₇N₂O₃S** Benzothiazole, 1 - methyl - 4 - nitro-, 2600⁸.
- 4 - Benzothiodiazolol, acetate, 2690⁸.
- Isothiocyanic acid, 3 - nitro - *o* - tolyl ester, 1637⁷.
- Thiocyanic acid, nitrotolyl ester, 1985⁴.
- C₈H₇N₂O₂** Benzisoxazole, 2-methyl-4-nitro-, 92².
- C₈H₇N₂O₄** Benzaldehyde, methoxydinitro-, 2675⁶.
- C₈H₇N₂O₇** Anisic acid, 2,3-dinitro-, 1971².
- Benzoic acid, methoxydinitro-, and salts, 2675^{7,8}.
- C₈H₇N₂O₃** 1 - Isoindazolecarboxamide, 6 - nitro-, 1120⁸.
- C₈H₇N₂O₄S₂** 1,3,4 - Thiodiazole, 2,2' - dithio-bis[5 - (carboxymethylmercapto)-], 383⁶.
- C₈H₇N₂O₄** 2(3) - Benzimidazolone, 1 - methyl-5,6-dinitro-, 383².
- C₈H₇O₂** 2(1)-Benzofuranone, 1260², 1678⁷.
- 2,2'-Bifuran, 3362⁶.
- Glyoxal, phenyl-, 426¹, 925⁵, 3646⁵.
- Phthalide, 911⁷.
- C₈H₇O₄** (See also *Piperonal*.)
- Benzaldehyde, 2,3 - methylenedioxy-, 588⁴.
- Glyoxylic acid, phenyl-, 426².
- Phthalaldehydic acid, 3356⁶.
- Phthalic anhydride, 4,5 - dihydro-, 2677⁸.
- C₈H₇O₄** (See also *Phthalic acid*.)
- Benzoic acid, 2,3 - methylenedioxy-, 588⁴.
- Isophthalic acid, 1258¹.
- Terephthalic acid, *Ca* salt, 1290⁹.
- C₈H₇AsClNO** Acetanilide, arsinosochlorohydroxy-, P 1691¹.
- C₈H₇AsClO₂** Acetic acid, (*o* - chlorophenyl)-arseno-, 1628¹.
- C₈H₇BrClNO** Acetanilide, α -bromo- α -chloro-, 2876².
- C₈H₇BrCl₂** Ethane, 1 - bromo - 1 - (2,4 - dichlorophenyl)-, 2673⁸.
- C₈H₇BrN₂O₂S** 1 - Methyl - 4 - nitrobenzothiazolol bromide, 2692⁷.
- C₈H₇BrN₂S** Benzothiazole, 5 - bromo - 1 - methyl-amino-, 584⁵.
- C₈H₇BrO₂** Vanillin, 2(and 6)-bromo-, 1803^{8,9}.
- C₈H₇Br₂ClO** Anisole, 3,5 - dibromo - 4 - chloro-2-methyl-, 3606⁸.
- C₈H₇Br₂ClO₂** Benzene, 1,3 - dibromo - 4 - chloro-2,5-dimethoxy-, 574⁸.
- C₈H₇Br₂NO₂** Vanillin, dibromo-, oxime, 2258⁴, 3898⁸.
- C₈H₇Br₂N₂O** Acetanilide, 4 - amino - 2,3,5-tribromo-, 2671⁵.
- C₈H₇Br₂O** Anisole, tribromomethyl-, 72².
- C₈H₇Br₂O₂** Creosol, 3,5,6-tribromo-, 2124¹.
- C₈H₇Br₂N₂S** Benzothiazole, 5 - bromo-1-methyl-amino-, hexabromide, 584⁵.
- C₈H₇CeO₄ + 4H₂O**, 867².
- C₈H₇CeO₄ + 4H₂O**, 867².
- C₈H₇ClNNaO₂S** Toluic acid, (chlorosulfamyl)-, *Na* deriv., *Ca* salt, P 593⁹.
- C₈H₇ClN₂O₄** Benzaldehyde, chloro - 3 - hydroxy-nitro-, semicarbazone, 3774^{3,4}.
- C₈H₇ClO** *p*-Tolualdehyde, 3-chloro-, P 1272⁸.
- α -Tolyl chloride, 3043⁸.
- C₈H₇ClO₂** Acetophenone, α - chloro - 2 - hydroxy-, 1254⁹.
- Benzaldehyde, 4 - chloro - 2 - methoxy-, 3189⁸.
- Benzoyl chloride, *o*-methoxy-, 3347¹.
- C₈H₇ClO₂S** Acetic acid, (chlorophenylmercapto)-, 1096⁷.
- C₈H₇ClO₃** Acetic acid, *o*(and *p*)-(chlorophenoxy)-, 1096⁷.
- Benzoic acid, 4-chloro-2-methoxy-, 3189⁸.
- Vanillin, chloro-, 906¹.
- C₈H₇Cl₂NO** Acetimidic acid, α , α - dichloro-, Ph ester, -HCl, 1256⁹.
- Acetophenone, 2 - amino - 3,4 - dichloro-, 3621⁵.
- C₈H₇Cl₂O₇** 4,4 - *m* - Dioxaneacetic acid, 4 - carbonyl-, 6 - keto - 2 - (trichloromethyl)-(?), 1962⁸.
- 1,3 - Dioxolane - 4,4 - diacetic acid, 5 - keto - 2 - (trichloromethyl) - (?), 1962⁸.
- C₈H₇Cl₂NO₂** Acetic acid, dichloro-, 2,4 - dichloroaniline salt, 1630².
- Acetic acid, trichloro-, *o* - chloroaniline salt, 1630².
- C₈H₇FO₃S** Benzoic acid, 5 - (fluorosulfonyl)-2-methoxy-, 3605⁸.
- C₈H₇IO₂** Acetic acid, iodophenoxy-, 1678⁷.
- C₈H₇LaO₄ + 4H₂O**, 867².
- C₈H₇LaO₄ + 4H₂O**, 867².
- C₈H₇MnO₄**, 540⁸.
- C₈H₇N** (See also *Indole*.)
- Tolunitrile, 55⁷, 775⁷, 1327, 735⁹, 1453⁹.
- C₈H₇NO** Anisonitrile, 775⁷.
- Benzisoxazole, 2-methyl-, 92², 3363².
- Benzonitrile, *o*-methoxy-, 77⁵.
- C₈H₇NO₃** Isothiocyanic acid, anisyl ester, 1637⁴.
- C₈H₇NO₂** Benzisoxazole, 2-methoxy-, 1120⁷.
- Benzisoxazolol, 2-methyl-, 3363^{8,9}.
- Glyoxal, α - phenyl-, β - oxime, 565².
- Indole, 5,6-dihydroxy-, 1994⁸.
- Styrene, β -nitro-, 2253⁸, 2255¹.
- C₈H₇NO₂** Anthranil, 1,2 - dihydro - 1,2 - methylendioxy-(?), 1641¹.

- 2(1) - Anthranilone, 1 - (hydroxymethyl)-, 1640^o.
 Benzaldehyde, 2,3 - methylenedioxy-, oximes, 588^o.
 Benzamide, 2,3-methylenedioxy-, 588^o.
 Isatic acid, 587^o.
 5(4) - Isoxazolone, 3 - (3 - methyl - 2 - furyl)-, 2896^o.
 Piperonal, oxime, -HCl, 1107¹.
 Toluene, α, α - methylenedioxy - *o* - nitroso-(?), 1641¹.
C₆H₇NO₄ Acid, m. 195^o, from yohimboic acid, 444^o.
 α -Toluidic acid, *o*-nitro-, 2250^o, 3608^o.
C₆H₇NO₃S Acetic acid, (nitrophenylmercapto)-, 1096^o.
 Picolinic acid, 3 - (carboxymethylmercapto)-, 407^o.
C₆H₇NO₃ Acetic acid, *o*(and *p*) - (nitrophenoxy)-, 1096^o.
 Benzaldehyde, 2,6 - dihydroxy-4 - methoxy-nitroso-(?), 2256^o.
 Quinone, 2,5 - dihydroxy-, oxime, acetate, 575^o.
 β - Resorcylaldehyde, 6 - methoxynitroso-(?), 2256^o.
C₆H₇NS *p*-Tolunitrile, α -mercapto-, 3898^o.
C₆H₇NS₂ Benzothiazole, 1 - mercapto - 4 (and 6)-methyl-, 2688^o.
C₆H₇N₂NaO₃ Isocresol, 3,4-dinitro-, Na deriv., 3607^o.
C₆H₇N₂O 2 - Indazolecarboxamide, 1119^o.
C₆H₇N₂OS Benzothiodiazole, 4-acetamido-, 2690^o.
 1,3,4 - Thiodiazol - 2(3) - one, 5 - anilino-, 2900^o.
C₆H₇N₂O₂ Indazole, 2 - methyl nitro-, 1119^o, 2693^o.
 Isoindazole, methyl-nitro-, 1119^o, 2693^o.
 1,3,4 - Oxidiazol - 2 - ol, 4,5 - dihydro - 5-imino-4-phenyl-, 913^o.
 α -Phenylenesemioxamazine, 2132^o.
 Pseudoisatin, 6-amino-, oxime, 912^o.
C₆H₇N₂O₃ 2(3) - Benzimidazolone, 1 - methyl-nitro-, 3831^o.
 Isoindazole, 6-methoxy-7-nitro, 1171^o.
C₆H₇N₂O₄ Benzaldehyde, 2,4-dinitro-, methyl-oximes, 743^o.
C₆H₇N₂O₅ Benzaldehyde, methoxydinitro-, oxime, 2675^o.
 Benzamide, methoxydinitro-, 2675^o.
C₆H₇N₂S Urea, (cyanophenyl)thio-, 1637^o.
C₆H₇N₂S₂ Δ^2 - 1,3,4 - Thiodiazoline - 2 - mercaptan, 5 - phenylimino-, 3199^o.
C₆H₇N₂O₃ Aniline, *N* - ethyl - *N*,2,4,6 - tetra-nitro-, 740^o.
C₆H₇NdO₄ + 4H₂O, 867^o.
C₆H₇NdO₅ + 4H₂O, 867^o.
C₆H₇O₂Pr + 4H₂O, 867^o.
C₆H₇O₂Pr + 4H₂O, 867^o.
C₆H₇ See *Styrene*.
C₆H₇AgN₃O₂ 3 - Triazene-carboxylic acid, 1-phenyl-, methyl ester, silver deriv., 2903^o.
C₆H₇AsNO₄ 4 - Benzoxazolecarsonic acid, 6-methyl-, P 3371^o.
C₆H₇As₂O₃ Acetic acid, phenylarseno-, 1028^o.
C₆H₇As₂O₄ Acetic acid, (*p* - hydroxyphenyl)-arseno-, 1628^o.
C₆H₇Bi₂K₂O₁₁S + 2H₂O, 2623^o.
C₆H₇Bi₂Na₂O₁₁S + 2H₂O, 2623^o.
C₆H₇Bi₂O₁₁S + 6H₂O, 2623^o.
C₆H₇BrNO₂ Benzene, (α - bromo - α - nitro ethyl)-, 73^o.
C₆H₇BrNO₂S Sulfide, β -bromoethyl nitrophenyl, 3191^o.
C₆H₇BrNO₂S Sulfoxide, β -bromoethyl nitrophenyl, 3191^o.
C₆H₇BrNO₄ Veratrole, 4-bromo-5-nitro-, 3607^o.
C₆H₇Br₂N₂OS Benzothiazole, 1-amino-5-methoxy-, dibromide, 2688^o.
C₆H₇Br₂N₂S Benzothiazole, 1-methylamino-, dibromide, 584^o.
C₆H₇Br₂O Anisole, 3,5-dibromo-2-methyl-, 3608^o.
C₆H₇Br₂O₂ Benzene, 1,3-dibromo-2,4-dimethoxy-, 236^o.
 Cresol, 3,5-dibromo-, 2124^o.
C₆H₇Br₂N₂S Benzothiazole, 1-amino-5-methyl-, tetrabromide, 2688^o.
C₆H₇Cd₂N₂O₁₁S + H₂O, 3327^o.
C₆H₇ClNO Acetanilide, chloro-, 2669^o, 3313^o, 3526^o.
 Acetimide acid, α -chloro-, (Ph ester, -HCl, 1256^o.
 Benzaldehyde, *p*-chloro-, methyloximes, 743^o.
 Carbanilyl chloride, *N*-methyl-, 1108^o.
 p -Toluhydroxamyl chloride, 1107^o.
C₆H₇ClNO₂ Anisohydroxamyl chloride, 1107^o.
 Benzaldehyde, 4-chloro-2-methoxy-, oxime, 3189^o.
 Xylene, 4 (and 5) - chloro - 2 - nitro-, 2670^o.
C₆H₇ClNO₂S Sulfide, β - chloroethyl nitrophenyl, 3191^o.
C₆H₇ClNO₂ Toluene, 5 - chloro - 4 - methoxy-2-nitro-, 1971^o.
 Vanillin, chloro-, oxime, and salts, 906^o.
C₆H₇ClNO₂S Sulfoxide, β - chloroethyl nitrophenyl, 3191^o.
C₆H₇ClNS α - Tolamide, *p* - chlorothio-, 1454^o.
C₆H₇ClN₂O Acetamidobenzenediazonium chloride, and *SbCl₅* compd., 1105^o.
C₆H₇ClN₂O₂ Benzaldehyde, 2-chloro-4-hydroxy-, semicarbazone, 3189^o.
 Salicylaldehyde, 4-chloro-, semicarbazone, 3189^o.
C₆H₇Cl₂O Benzyl alcohol, 2,4-dichloro- α -methyl-, 2673^o.
 α -Toluyyl chloride, α -chloro-4,5-dihydro-(?), 2678^o.
C₆H₇Cl₂O₂ Benzene, 2,3-dichloro-1,4-dimethoxy-, 1254^o.
C₆H₇Cl₂NO₂ Acetic acid, dichloro-, *o*-chloro aniline salt, 1630^o.
 Aniline, trichloroacetate, 3905^o.
C₆H₇Cl₂NO₂ Acetic acid, trichloro-, *p*-amino-phenol salt, 1630^o.
C₆H₇Cl₂O₂Zr Addn. compd. of ZrCl₄ and methyl salicylate, 1069^o.
C₆H₇FNO₂S Xylenesulfonyl fluoride, nitro-, 3604^o.
C₆H₇FNO₂S Benzenesulfonyl fluoride, 4-ethoxy-3-nitro-, 3605^o.
C₆H₇F₂O₂S *m*-Benzenedisulfonyl fluoride, 2,4-dimethyl-, 3604^o.
C₆H₇Hg₂INO₂ Aniline, 2 (and 4)-(acetoxymethyl)-4 (and 2)-iodo-, 3961^o.
C₆H₇INO₂S Sulfide, β -iodoethyl nitrophenyl, 3191^o.
C₆H₇INO₂S Sulfanilic iodide, *N*-acetyl-, 234^o.
C₆H₇I₂N₂O Acetanilide, 5-amino-2,4-diiodo-, 2671^o.
C₆H₇I₂O₂ Benzene, 1,5-diiodo-2,4-dimethoxy-, 1982^o.
C₆H₇NNaO₂S See *Casaprin*.
C₆H₇N₂ Benzimidazole, 2-methyl-, 2133^o.

- 1,4 - Imidazopyridine, 2 - methyl-, and -HBr, 2467.³
- C₈H₇N₃O** Benzisoxazole, 4-amino-2-methyl-, 921.
- Glycinonitrile, *N* - (o - hydroxyphenyl)-, 1449⁹.
- 6 - Isoindazolol, 1 - methyl-, 1120⁸.
- C₈H₇N₃O₂** Benzothiazole, 1 - amino - 5 - methoxy-, 2688².
- C₈H₇N₃O₂** 2,3-Indoleol, 6-amino-, 912⁴.
- C₈H₇N₃O₂** Benzaldehyde, *o* (and *p*) - nitro-, methyloximes, and -HCl, 741.^{3,9}
- Benzamide, *N* - methyl - *o* - nitro-, 751.
- Benzohydroxamide, 2,3 - methylenedioxy-, 588².
- Glycine, *N*-nicotinyl-, 951.
- Glyoxylohydroxamic acid, phenyl-, oxime, 733²; *N*₂H₄ salt, 1976¹.
- Methazonic acid, β -phenyl-, and *Ni* salt, 239², 240¹.
- Nicotinuric acid, 118³.
- Urea, salicylyl, 1806⁹.
- C₈H₇N₂O₂** Acetanilide, 2-hydroxy-6-nitro-, 2675⁴.
- Quinone, 2 - amino - 5 - hydroxy-, 1 - oxime, acetate, 575².
- C₈H₇N₂O₂** Anisole, 4 - methyl - 2,3 (and 2,6)-dinitro-, 1970².
- Isobarbituric acid, diacetate, 1447².
- Phenotole, 2,4-dinitro-, 3049³.
- C₈H₇N₂O₂** Creosol, 3,6-dinitro-, 3607⁷.
- Isocresol, 3,4-dinitro-, 3607⁸.
- Veratrole, 3,6-dinitro-, 376².
- C₈H₇N₂S₂** Benzothiazole, 4-amino-1-mercapto-5-methyl-, 2689².
- C₈H₇N₂O** Carbanilyl azide, *N*-methyl-, 2899⁷.
- C₈H₇N₂O** Aniline, *N*-ethyl-2,4,6-trinitro-, 740¹.
- C₈H₇O** (See also *Acetophenone*.)
- Toluene, 1452², 1452³, 2430², 3895⁷.
- C₈H₇O₂** Acetic acid, thiono-, Ph ester, 2458².
- C₈H₇O₂** Benzoic acid, *p*-hydroxydithio-, Me ester, 3196².
- C₈H₇O₂** (See also *Toluic acid*.)
- Acetic acid, Ph ester, 557, 387³, 1216², 1678², 3609².
- Acetophenone, *p*-hydroxy-, 3609².
- Anisaldehyde, 55², P 127², 2472², 3017².
- Benzoic acid, Me ester, 55², 3303².
- Δ^1 -2-Butenone, 4-(2-furyl)-, 86², 3903².
- Cresotaldehyde, 378².
- Phlorone, 575², 843².
- Phthalide, 4,5-dihydro-, 2678¹.
- Salicylaldehyde, Me lactolide, 1448².
- α -Tolualdehyde, *o*-hydroxy-, 2875¹.
- Xyloquinone, 1254¹, 1452⁷.
- C₈H₇O₂S** Acetic acid, phenylmercapto-, 1096⁷.
- Benzoic acid, *o*-(methylmercapto)-, *II* salt, 1257⁷.
- p*-Toluic acid, α -mercapto-, 3899¹.
- C₈H₇O₂S** Acetic acid, (*p*-mercaptophenylmercapto)-, 1096⁷.
- C₈H₇O₂** (See also *Mandelic acid*; *Vanillin*.)
- Acetic acid, phenoxy-, 1096², 1642¹, 1675².
- Acetophenone, dihydroxy-, 1265², 1803².
- Anisic acid, 81².
- Benzaldehyde, 3-hydroxy-5-methoxy-, 3356⁷.
- Benzoic acid, *p*-hydroxy, Me ester, 1329².
- , methoxy-, 81², 1980⁴.
- Cresotic acid, 1497⁴.
- 1,2 - Cyclohexenedicarboxylic anhydride, 2676², 2678².
- Pyrocatechol, monoacetate, 1630⁷.
- Salicylic acid, Me ester, 235², 1805², 2170², 2294², 2848².
- α -Toluic acid, *p*-hydroxy-, 1308².
- C₈H₇O₂S** Acetic acid, (phenylsulfonyl)-, 1096⁷.
- C₈H₇O₂** Acetophenone, 3,4,5-trihydroxy-, 1108¹.
- Benzaldehyde, 2,6 - dihydroxy - 4 - methoxy-(?), 2256⁷.
- Benzoic acid, 3 - hydroxy - 5 - methoxy-, 3350².
- Fisetol, 3904².
- Phloracetophenone, 1974⁷.
- β - Resorcyaldehyde, 6 - methoxy-(?), 2256⁷.
- C₈H₇O₂** 2 - Furanicarboxylic acid, 5 - (hydroxymethyl), acetate, 3183¹.
- 2,3 - Furanedicarboxylic acid, dimethyl ester, 2890².
- C₈H₇O₂S** 6 - Guaiacolsulfonic acid, 4 - formyl-, 2272².
- C₈H₇S₂** Toluic acid, dithio-, 3609^{2,3}.
- C₈H₇Se** Acetophenone, seleno-, 1963³.
- C₈H₇AsINO₃** *m* - Arsanilic acid, *N* - acetyl - 4-hydroxy-5-iodo-, 70¹.
- C₈H₇AsNO₃** 6 - Quinoxalinearsenic acid, 1,4-dihydro - 2 (and 3) - hydroxy-, 2255².
- C₈H₇AsO₃** Benzenearsonic acid, *p*-acetyl-, P 3371⁴.
- C₈H₇AsO₃** Acetic acid, (*p*-arsenophenoxy)-, 3895².
- C₈H₇AsNO₂** Acetic acid, (*p*-aminophenylarseno)-, -HCl, 1627².
- C₈H₇AsNO₂** Acetic acid, (3-amino-4-hydroxyphenyl)arseno-, 1628¹.
- C₈H₇AsNO₂** Acetic acid, 3-amino-4-hydroxyphenyltetraarseno-, 1628².
- C₈H₇AsNO₂** Acetic acid, 3-amino-4-hydroxyphenylhexaarseno-, 1628².
- C₈H₇BrNO** Acetanilide, 4-amino-2-bromo-, 2671².
- Aniline, 3 - bromo - *N,N* - dimethyl - 4-nitroso-, 903², 2669².
- C₈H₇BrN₂S** Urea, α - (*p* - bromophenyl) - β -methylthio-, 584⁴.
- C₈H₇BrO** Ether, bromobenzyl methyl-, 2466².
- C₈H₇BrO₂** Benzene, 1 - bromo - 2,4 - dimethoxy-, 236².
- C₈H₇BrO₂** Muconic acid, α - bromo-, di-Me ester, 1332².
- C₈H₇Br₂O₂** Glutaric acid, α,γ - dibromo - β -(homocarbonylmethyl) - β - methyl-, 3045⁴.
- C₈H₇Cl** Benzene, (chloroethyl)-, 563², 1454¹, 1635².
- C₈H₇ClNO₂Sb** Benzenestibonic acid, 4-acetamido-3-chloro-, P 249¹; *Na* salt, 3191².
- C₈H₇ClNO₂** Acetanilide, 4-amino-2-chloro-, 2669².
- Aniline, 3 - chloro - *N,N* - dimethyl - 4-nitroso-, 2669².
- 1 - Isoindazolecarboxyl chloride, tetrahydro-, 2000³.
- C₈H₇ClN₂O₂** Vanillin, chloro-, hydrazone, 906².
- C₈H₇ClO₂** Creosol, 5-chloro-(?), 3607².
- C₈H₇ClO₂S** α - Toluenesulfonyl chloride, α -methyl-, 2673².
- C₈H₇Cl₂NO** Acetic acid, dichloro-, *p*-aminophenol salt, 1630².
- C₈H₇CrN₂O₂** Acetamidobenzenediazonium chromate, 1105^{2,3}.
- C₈H₇F** *m*-Xylene, 4-fluoro-, 2668⁴.
- C₈H₇FO₂S** Xylenesulfonyl fluoride, 3604².
- C₈H₇FO₂S** Benzenesulfonyl fluoride, *p*-ethoxy-, 3605⁴.
- C₈F₇INO** Aniline, 3-iodo-*N,N*-dimethyl-4-nitroso-, 2669².
- C₈H₇NO** (See also *Acetanilide*.)

- Acetimidic acid, Ph ester, -HCl, 1256⁸.
 Acetophenone, oxime, 75⁸.
 Benzaldehyde, methyloximes, and -HCl, 74^{3,9}.
 Formanilide, *N*-methyl-, *POCl*₃ compd., 1452¹.
 Formimidic acid, benzyl ester, -HCl, 387⁹.
 Phthalimidine, 5,6 dihydro-, 2678⁴.
C₈H₉NO₂ Anthranilaldehyde, 3-methoxy-, 377¹.
 Benzene, nitroethyl-, 1250⁷, 2255².
 Benzoic acid, amino-, methyl ester, 2848².
 Δ¹-1,2-Cyclohexenedicarboximide, 2468¹.
 Formohydroxamic acid, benzyl ester, 388².
 Nicotinic acid, Et ester, 2493².
 Picolinic acid, Et ester, 406⁷.
 Resorcinol, 4-(α-iminoethyl)-, and salt, 1256⁹, 1257¹.
 α-Toluic acid, α-amino-, 1662¹, 1932², 3900².
C₈H₉NO₃ Acetic acid, (*p*-aminophenylmercapto)-, 1096⁹.
C₈H₉NO₃ (See also *Orthoform*.)
 Glycine, *N*-(*p*-hydroxyphenyl)-, 1794⁴.
 Phenetole, *p*-nitro-, 3049³.
C₈H₉NO₃ Benzenesulfinic acid, *m*-acetamido-, 234⁴.
 2-Benzisulfonazolid, 1,2-dihydro-2-methyl-, and -HCl, 3202⁴.
 Ethanol, 2-(nitrophenylmercapto)-, 3191^{1,3}.
C₈H₉NO₃ Creosol, 3-nitro-, 3607⁸.
 Isocresol, 4-nitro-, 3607^{7,9}.
C₈H₉NO₃ Anisole, 2-(methylsulfinyl) 4-nitro-, 905^{4,7}.
 Sulfone, methyl *o*(*m* and *p*)-nitrobenzyl-, 2254⁸.
C₈H₉NO₃ Pyromucuric acid, 5-(hydroxymethyl)-, 3912⁹.
C₈H₉NO₃ Anisole, 2-(methylsulfonyl)-1-nitro-, 905⁸.
 α-Toluenesulfonic acid, *o*(*m* and *p*)-nitro-, Me ester, 2254⁷.
C₈H₉NS₂ Carbamic acid, dithio-*p*-tolyl-, *Λ* *u* salt, 67⁸.
C₈H₉N₂ Indazole, 5-amino-2-methyl-, 2693¹.
 Isoindazole, aminomethyl-, 1127⁸, 2693⁴.
C₈H₉N₂O 2(3)-Benzimidazolone, amino-1-methyl-, and -HCl, 3831^{1,2}.
C₈H₉N₂O₂ Acetaldehyde, *o*-nitrophenylhydrazine, 2133¹.
 3-Triazencarboxylic acid, 1-phenyl-, methyl ester, 2003⁷.
 Urea, (*o*-formylphenyl)-, oxime, 1119³.
C₈H₉N₂O₂ Carbazic acid, dithio-, *o*-nitrobenzyl ester, 383⁴.
C₈H₉N₂O₂ Urea, α-(*o*-formylphenyl)-β-hydroxy-, oxime, 1119⁷.
C₈H₉N₂O₃ 1,3,5(2,6)-Isoimidazimidazoletrione, 7-methoxy-2,6-dimethyl-, 3353¹.
 Urea, (*p*-nitrobenzyloxy)-, 2257⁸.
C₈H₉O₂P *o*-Phenylene ethyl phosphate, 2461⁶, 3057¹.
C₈H₁₀ (See also *Benzene*, *ethyl*-; *Xylene*.)
 1,7-Octadiene, 730⁶.
C₈H₁₀AsHgNO₃ Compd. from *N*-acetyl-4-hydroxy-*m*-arsanilic acid and Hg(OAc)₂, 70⁸.
C₈H₁₀AsNO Aniline, *p*-arsinoso-*N*, *N*-dimethyl-, 1973⁹.
C₈H₁₀AsNO₂ Acetanilide, 5-arsyl-2-hydroxy-, P 745².
C₈H₁₀AsNO₃ Arsacetin, 2316¹, 2329¹, 3394¹.
C₈H₁₀AsNO₃ (See also *Stoversol*.)
 Arsanilic acid, *N*-acetylhydroxy-, 775⁹, 3896^{3,4}.
C₈H₁₀AsN₂O₃ Arsanilic acid, *N*-(carbamylmethyl)-3-nitro-, 2255⁸.
C₈H₁₀Br₂O₃ α-Hydromuconic acid, γ,δ-dibromo-, di-Me ester, 1632⁸.
C₈H₁₀ClN Benzylamine, *p*-chloro-*N*-methyl-, and -HCl, 53⁹.
 2,6-Xylidine, 3(and 4)-chloro-, 2670⁴.
C₈H₁₀Cl₂O Δ¹-Cyclohexenecarboxyl chloride, 6-(chloromethyl)-(?), 2677⁸.
C₈H₁₀FNO₃ 2,4-Xylenesulfonyl fluoride, 5-amino-, and -HCl, 3004⁸.
C₈H₁₀Hg Benzyl methyl mercury, 233⁹.
C₈H₁₀HgN₂O₄ 4(or 5)-Imidazolecarboxylic acid, 1-(acetoxymethyl)-, Et ester, 3615².
C₈H₁₀N₂ 2-Pyrrolenitrile, 3,4,5-trimethyl-, 85⁹.
C₈H₁₀N₂O (See also *Pyroindole*.)
 Aniline, *N*, *N*-dimethyl-*p*-nitroso-, 736¹, 1800².
C₈H₁₀N₂O₃ Urea, anisylthio-, 1637⁷.
C₈H₁₀N₂O₃ Glyoxime, *p*-tolyl-, 1977⁸.
 3-Indazolecarboxylic acid, tetrahydro-, 2900².
 Phenethylamine, nitro-, 1250^{4,8}.
 Pyrazolecarboxylic acid, allylmethyl-, 2899².
 Urea, α-methoxy-β-phenyl-, 2249².
C₈H₁₀N₂O₃ Anisidine, methylthio-, 1070⁹, 1971^{1,3}.
 Hydroxylamine, *p*-*o*-methoxybenzyl-β-nitroso-, 2257⁹.
p-Phenetidine, 3-nitro-, 1451³.
C₈H₁₀N₂O₃ Benzamide, *m*-(methylsulfamyl)-, 3604².
C₈H₁₀N₂O₄ α-Toluenesulfonamide, *N*-methyl-*o*(*m* and *p*)-nitro-, 2254⁸.
C₈H₁₀N₂O₄ Hydrouacil, 5,5,6-trihydroxy-, diacetate, 1147⁹.
C₈H₁₀N₂O Benzaldehyde, 1-aminosemicarbazone, 1249¹.
C₈H₁₀N₂O₃ Semicarbazide, 2-carbamyl-4-phenylthio-, 1799¹.
C₈H₁₀N₂O₂ (See also *Caffeine*; *Cryogenin*.)
 Guanidine, α-benzyl-γ-nitro-, 1968⁸.
 Xanthine, 7-ethyl-8-methyl-, 1448¹.
C₈H₁₀N₂S₂ Biurea, β-phenyldithio-, 2001⁴.
C₈H₁₀O (See also *Phenethyl alcohol*; *Phenetole*.)
 Anisole, *p*-methyl-, 557, 1106¹.
 Benzyl alcohol, methyl-, 72¹, 202¹, 3603⁸, 3887⁸.
 Xyleneol, 1452⁶, 1453⁴.
C₈H₁₀OS Anisole, *o*-(methylmercapto)-, 905^{8,9}.
C₈H₁₀O₂ 2-Butanone, 4-furyl-, 86¹, 1116².
 Δ³-1-Butenol, acetate, 1581¹.
 Δ¹-Cyclohexenecarboxylic acid, (hydroxymethyl)-, lactone, 2677¹, 2678⁹.
 1,2-Ethanediol, phenyl-, P 2136⁹.
 Furan, 2-(allyloxymethyl)-, 1048⁸.
 Pyrocatechol, dimethyl-, 814⁴.
o-Toluic acid, 4,5-dihydro-, 2678².
 Xylohydroquinone, 843³, 1453⁴.
 Xyloquinol, 1453¹, 2124⁴.
C₈H₁₀O₂S Anisole, *o*-(methylsulfinyl)-, 905⁸.
C₈H₁₀O₂Se Xyleneseleninic acid, 1252².
C₈H₁₀O₃ 1,2-Cyclobutanedicarboxylic anhydride, 3,4-dimethyl-, 3603⁸.
 Elsholtzic acid, ethyl ester, 2806⁸.
 Furanglycolic acid, Et ester, P 3057⁸.
o-Toluic acid, 4,5-dihydro-α-hydroxy-, 2678¹.
C₈H₁₀O₃S Anisole, *o*-(methylsulfonyl)-, 905⁸.
 Methanesulfinic acid, hydroxy-, phenyl ester, 3171¹.

- α - Toluenesulfonic acid, α - methyl-, 527;
and salts, 2673^a.
- p - Toluenesulfonic acid, Me ester, 3888¹.
- 2,4 - Xylenesulfonic acid, *Na salt*, 740^a.
- $C_8H_{10}O_4$ Aconic acid, 2,4 - dimethyl-, Me ester, 388^a.
- Δ^3 - 1,3 - Cyclohexenedicarboxylic acid, 1258¹.
- Δ^1, α - Cyclopentanemalononic acid, 227^a.
- 2 - Furancarboxylic acid, 5 - (methoxy-methyl)-, Me ester, 3183¹.
- Muconic acid, di-Me ester, 3890^a.
- $C_8H_{10}O_8$ Citric acid, acetyl-, 11^a.
- Peroxide, bis(γ - carboxypropionyl)-, 1454^a.
- $C_8H_{10}S$ Benzyl mercaptan, α -methyl-, 527.
- Sulfide, methyl p -tolyl-, 1106¹.
- $C_8H_{11}AsN_2O_2$ Arsanilic acid, N - glycyl-, 70^a.
- $C_8H_{11}ClN_2O_2$ Pyrimidine, chlorodiethoxy-, 2271^a.
- $C_8H_{11}ClO_3$ 2,4,6 - Trimethylpyrylium perchlorate, 1814².
- $C_8H_{11}ClO_6$ See *Chloralose*.
- $C_8H_{11}N$ (See also *Aniline*, *N*, *N*-dimethyl-; *Phenethylamine*; *Xylidine*.)
- Aniline, *N*-ethyl-, 1250^a, 1678^a.
- Benzylamine, α -methyl-, 1250^a, and - *HCl*, 3346^a.
- Collidine, 480^a.
- Indole, tetrahydro (?), 3054^a.
- $C_8H_{11}NO$ (See also *Ephedrine*; *Tyramine*.)
- Ketone, 2,4 - dimethyl-3 - pyrrol methyl-, 381^a.
- Phenitidine, 1328^a, P 3058².
- Phenol, p -ethylamino-, 2886³.
- Phthalimidine, tetrahydro-, 2677^a, 2678^a.
- 2 - Pyrrolealdehyde, 3,4,5 - trimethyl-, *Salt*.
- $C_8H_{11}NO_2$ Aniline, 3,4-dimethoxy-, 1635⁷.
- Cyclobutanecarboxylic acid, 1-cyano-, Et ester, 1249⁷.
- 1,2 - Cyclohexanedicarboximide, 2877⁷.
- Hydroxylamine, β - *o* - methoxybenzyl-, - *HCl*, 2257^a.
- 2 - Pyrrolecarboxylic acid, 3,4,5 - trimethyl-, 85^a.
- 3 - Pyrrolepropionic acid, 4 - methyl-, 102^a.
- Spiro [cyclopentane-succinimide], 2877¹.
- $C_8H_{11}NO_2S$ Ethanesulfonamide, 2 - phenyl-, 2673^a.
- $C_8H_{11}NO_2S$ Inide from hematoporphyrin, 3060⁴.
- $C_8H_{11}NO_2S$ 1 - Phenol - 4 - sulfonamide, *N*, *N*-dimethyl-, 3605¹.
- Sulfamic acid, dimethyl-, Ph betaine, 94^a.
- $C_8H_{11}N_2O$ (See also *Muretin*.)
- 4 - Quinazolinol, 2 - amino - 5,6,7,8 - tetrahydro-, 3198⁷.
- Urea, (6 - ethoxy - 3 - pyridyl)-, 1814².
- $C_8H_{11}NO_2S_2$ Δ^1 - 1,3,4 - Thiodiazoline, 4 - acetyl-5 - (allylimino) - 2 - benzothiazoline, 3200¹.
- $C_8H_{11}N_2O_2$ Hydrazine, α - ethyl - α - (p - nitrophenyl)-, and - *HCl*, 1251^{2,3}.
- $C_8H_{11}N_2O_3$ 2 - Furaldehyde, 5 - (methoxy-methyl)-, semicarbazone, 3183¹.
- m* - Phenylenediamine, 4 - ethoxy - 2 - nitro-, 2260^a.
- $C_8H_{11}OP$ Phosphine oxide, dimethylphenyl-, 66^a.
- C_8H_{11} Hydrocarbon, b. 126-7°, 56^a.
- $C_8H_{11}AsBrH_4$, 2855^a.
- $C_8H_{11}AsN_2O_2$ Arsanilic acid, N - β - hydroxyethyl-, P 2908¹.
- $C_8H_{11}BaCr_2N_2S_8 + 2H_2O$, 1587^a.
- $C_8H_{11}BrN_2O_2$ Scopium bromide, 3365⁴.
- $C_8H_{11}Br$, 2,4 - Hexadiene, 3,4 - dibromo - 2,5-dimethyl-(?), 56¹.
- 3 - Hexine, 2,5 - dibromo - 2,5 - dimethyl-, 56².
- 1,7 - Octadiene, 2,7 - dibromo-, 730^a.
- $C_8H_{11}Cr_2N_2S_8 + 6H_2O$, 1587^a.
- $C_8H_{11}ClNO$ 1 - (γ - Hydroxypropyl)pyridinium chloride, 1977^a.
- $C_8H_{11}Cl_2O_2$ Adipyl chloride, α, γ - dimethyl-, 230^a.
- Cyclohexanecetic acid, α, α -dichloro-, 2876¹.
- $C_8H_{11}Cr_2N_2S_8 + 6H_2O$, 1587^a.
- $C_8H_{11}MoO_3$, 865^a.
- $C_8H_{11}Mo_2O_2$, 865^a.
- $C_8H_{11}N_2$ Pyrrole, 2 - (iminomethyl) - 3,4,5-trimethyl-, and - *HCl*, 85^a.
- $C_8H_{11}N_2O$ 2 - Pyrrolealdehyde, 3,4,5 - trimethyl-, oxime, 85^a.
- $C_8H_{11}N_2O_2$ p - Phenylenediamine, 2,3 - dimethoxy-, 370^a.
- $C_8H_{11}N_2O_3$ (See also *Barbital*.)
- Hydantoin, 1 - acetyl - 3,5,5 - trimethyl-, 1791^a.
- 4 - Imidazolecarboxylic acid, 2,3 - dihydro-2 - keto - 1,3,5 - trimethyl-, Me ester, 3353⁷.
- $C_8H_{11}N_2O_2S_2$ *S* - Phenylthiosulfuric acid, 2-amino - 5 - dimethylamino-, 1985^a.
- $C_8H_{11}N_2O_6$ Scopium nitrate, 3365⁴.
- $C_8H_{11}N_2O$ Desoxycaffeine, 3186².
- Semicarbazide, 4 - (*N* - methylanilino)-, - *HCl*, 69¹.
- $C_8H_{11}N_2O_3$ Uric acid, 4,5 - dihydro - 4,7,9-trimethyl-, 3353⁷.
- $C_8H_{12}O$ Cyclopentanone, 2-isopropylidene-, 1103².
- 2 - Propanone, 1 - Δ^1 - cyclopentenyl-, 3186^a.
- $C_8H_{11}O_2$ Δ^1, α - Cyclohexanecetic acid, 1636^a; *Na salt*, 1637^{1,2}.
- 1,3 - Cyclohexanedione, 5,5 - dimethyl-, 2872^a, 3202⁷.
- Δ^1 - Cyclohexenecetic acid, 1036^a, 1637¹.
- Δ^1 - Cyclohexenecarboxylic acid, methyl-, 2677^a, 2678^a.
- Δ^1 - Cyclopentenecarboxylic acid, ethyl ester, 2877⁷.
- Furan, 2-propoxymethyl-, 1648^a.
- $C_8H_{12}O_3$ Δ^1 - Cyclohexenecarboxylic acid, (hydroxymethyl)-, and *Ag salt*, 2677^a, 2678⁷.
- Cyclopentanecarboxylic acid, 2-keto-, Et ester, 375⁷.
- Resin acid from rubber, 1902^a.
- $C_8H_{12}O_3$ 1,2 - Thiopyran - 3 - carboxylic acid, 5,6 - dihydro - 1 - hydroxy-, Et ester, 1262¹.
- 1,2 - Thiopyran - 3 - carboxylic acid, 3,4,5,6-tetrahydro - 4 - keto-, Et ester, 1262¹.
- $C_8H_{12}O_4$ Δ^1 - 1,4 - Butenediol, diacetate, 1096^a.
- 1,2 - Cyclobutanedicarboxylic acid, 3,4-dimethyl-, 3603^a.
- Cyclohexanedicarboxylic acid, 229^a, 590^a.
- Cyclohexanecetic acid, 2 - carboxy-, 2877^a.
- Fumaric acid, diethyl ester, 1398⁷.
- Malic acid, diethyl ester, 1398⁷.
- Paraconic acid, 2 - ethyl - 2 - methyl-, and *Ag salt*, 2877^{a,3}.
- $C_8H_{12}O_3$ 2 - Pyranecarboxylic acid, 5 - ethoxy-tetrahydro-6-keto-, 3890^a.
- $C_8H_{12}Br$ 2,4 - Hexadiene, 6 - bromo - 2,5 - dimethyl-, 3042^a.
- $C_8H_{12}BrN_2O_4$ Glycine, *N* - [*N* - (α - bromopropionyl)alanyl]-, 97^a.

- [Hydrouracil, 6 - bromo - 5,5 - dimethoxy-1,3-dimethyl-, 14477.
- C₂H₁₃BrO₂ Cyclohexanol, 2-bromo-, acetate, 571⁸.
- C₂H₁₃BrN₂O₂ 1,3,5,4 - Oxidiazin - 4 - one, 2 - ethylidenetetrahydro - 3,5 - dimethyl-6-methylimino-, tetrabromide, 2131⁸.
- C₂H₁₁ClN₂O₄ Hydrouracil, 6 - chloro - 5,5-dimethoxy - 1,3 - dimethyl-, 14477.
- C₂H₁₃ClO Cyclohexanone, 2 - chloro - 3,5-dimethyl-, 2307.
- Pentenyl chloride, α -ethyl- β -methyl-, 3187⁸.
- C₂H₁₃ClO₂ Cyclohexanecetyl chloride, 1-hydroxy-, 3186⁸.
- Cyclohexanol, 2-chloro-, acetate, 571⁸.
- C₂H₁₃ClO₂ Malic acid, chloro-, di-Et ester, 570¹.
- C₂H₁₃Cl₂O₂ 1 - Pentanol, 1 - (trichloromethyl)-, acetate, 1625⁸.
- 1 - Propanol, 2 - methyl - 1 - (trichloromethyl)-, propionate, 1625⁸.
- C₂H₁₃IN₂ 1 - Allyl - 2,3 - dimethylpyrazolium iodide, 2899⁸.
- Pyridine, 1,2 - dihydro - 1 - methyl - 2-methylimino-, methiodide, 247¹.
- Pyridine, 2 - dimethylamino-, methiodide, 247¹.
- C₂H₁₃N α - Pentenenitrile, α - propyl-, 2118⁸.
- Pyrrole, butyl-, 2451⁸.
- Pyrrole, 4 - ethyl - 2,3 - dimethyl-, 104¹.
- Senecionitrile, α - isopropyl-, 2118⁸.
- C₂H₁₃NO α - Octinamide, 2875⁸.
- C₂H₁₃NO₂ 4-Carboxy - 1,1 - dimethyl - 2 - methylenepyrrolidinium hydroxide, betaine, 1813¹.
- Glutarimide, β -ethyl- β methyl-, 1968¹.
- 5(4) - Oxazolone, 4 - isobutyl - 2 - methyl-, 61⁸.
- Pseudoscopine, and salts, 3365⁸.
- Succinimide, α , α -diethyl-, 2877¹.
- C₂H₁₃NO₂ Cyclohexanecarboxylic acid, 1-carbamyl-, 229⁸.
- α - Pentenic acid, α - acetamido - γ - methyl-, 1966⁸.
- Pseudoscopine, N - oxide, 3365⁸.
- C₂H₁₃NO₄ Glycine, (α - keto - γ - methylvaleryl)-, 3892⁷.
- 2 - Pyranecarboxamide, 5 - ethoxytetrahydro-6-keto-, 3890⁸.
- C₂H₁₃NO₂S Ethylsulfuric acid, PhNH₂ salt, 53².
- C₂H₁₃N₂O₂ Δ^1 - Cyclohexenealdehyde, 2 - hydroxy-, semicarbazone, 2900⁸.
- 1,3,5,4 - Oxidiazin - 4 - one, 2 - ethylidenetetrahydro - 3,5 - dimethyl - 6 - methylimino-, and derivs., 2130⁸, 2131⁸.
- C₂H₁₃N₂O₂ Δ^1 - 1,1,5 - Pentenetricarboxamide, 2659⁸.
- C₂H₁₄ 2,4 - Hexadiene, 2,5 - dimethyl-, 3042⁸.
- C₂H₁₄AgN₃ s - Triazole, 3,5 - diisopropyl-, Ag deriv., 3201¹.
- C₂H₁₄BrNO₂ 4 - Carboxy - 1,1 - dimethyl - 2-methylenepyrrolidine bromide, 1813¹.
- C₂H₁₄BrNO₂ Butyric acid, α - (α - bromoisobutyrylamino)-, 1966⁸.
- Sarcosine, N - (α - bromoisovaleryl), 100⁸.
- C₂H₁₄Br₂ Hexene, dibromo - 2,5 - dimethyl-, 3042⁸.
- C₂H₁₄Br₂IN Bis(β - bromoallyl)dimethylammonium iodide, 53⁸.
- C₂H₁₄Cl₂IN Bis(β - chloroallyl)dimethylammonium iodide, 53⁸.
- C₂H₁₄N₂O 4 - Pyrazolol, 3 - isomyl-, 3903⁸.
- C₂H₁₄N₂O₂ 2,5 - Piperazinedione, 3 - butyl-, 1965⁸.
- 2,5 - Piperazinedione, isobutyl-, 567⁸, 1680¹.
- , 6 - ethyl - 3,3 - dimethyl-, 1966⁸.
- C₂H₁₄N₂O₂ 1,1 - Cyclohexanedicarboxylic acid, monohydrate, 229⁸.
- C₂H₁₄N₂O₂ Hydrouracil, 5,5-diethoxy-6-hydroxy-(?), 1447⁸.
- Hydrouracil, 6 - hydroxy - 5,5 - dimethoxy-1,3-dimethyl-(?), 1447⁸.
- Isobarbituric acid, 5,6-diethoxy-5,6-dihydro-(?), 1447⁸.
- , 5,6 - dihydro - 5,6 - dimethoxy - 1,3-dimethyl-(?), 1447⁸.
- C₂H₁₄N₂O₂S See *Glutathione*.
- C₂H₁₄N₂O₂V Ethylenediamine, vanadylmalonate, 2230⁷.
- C₂H₁₄NiO₂S Acetic acid, mercapto-, Ni deriv., 908².
- Propionic acid, β - mercapto-, Me ester, Ni deriv., 908².
- C₂H₁₄O Cyclohexanone, dimethyl-, 230⁸, 2464⁸.
- Cyclopentanone, 2-isopropyl-, 2667⁸.
- $\Delta^{2,4}$ - 1 - Hexadienol, 2,5 - dimethyl-, 3042⁷.
- Isobenzofuran, 1,2,2,3,4,5,6,6a - octahydro-, 590⁸.
- C₂H₁₄O₂ Hexenediol, dimethyl-, 55⁸, 56⁸, 3534⁸.
- $\Delta^{2,4}$ - 4,5 - Octadienediol, 3188⁸.
- Pentenic acid, α -ethyl- β -methyl-, 3187⁸.
- Δ^4 - 2 - Pentenol, 2 - methyl-, acetate, 1581¹.
- C₂H₁₄O₄ Adipic acid, α , γ - dimethyl-, 230⁸.
- Adipic acid, dimethyl ester, 1216⁸.
- Suberic acid, 258⁸, 1631⁸, 1964⁸.
- Succinic acid, diethyl ester, 1398⁷.
- C₂H₁₄O₅ Arabinose, monoacetone-, 1968⁸.
- Arabonolactone, trimethyl-, 1966⁸, 2250⁷, 2879⁸.
- Xylonolactone, trimethyl-, 2879⁸.
- C₂H₁₄O₇ d-Glucose, acetate, 392².
- C₂H₁₄O₈ Orthoformic acid, trithio-, triethylester, 73¹.
- C₂H₁₄Br Cyclohexane, 1-bromo-3,5-dimethyl-, 230⁸.
- C₂H₁₄BrO Phenetole, 2 - bromohexahydro-, 571⁸.
- C₂H₁₄Cl Cyclohexane, 1 - chloro - 3,5 - dimethyl-, 230⁸.
- C₂H₁₄ClO Caproyl chloride, α , α - dimethyl-, 1796⁸.
- Isocaproyl chloride, α , α -dimethyl-, 1796⁷.
- C₂H₁₄Cl₂O₂Pb Triethyllead trichloroacetate, 1445⁷.
- C₂H₁₄IO Phenetole, hexahydro-2-iodo-, 571⁷.
- C₂H₁₄N See *Conicine*; *Conicine*.
- C₂H₁₄NO (See also *Tropine*.)
- Cyclohexanone, 1,3-dimethyl-, oxime, 230⁷.
- C₂H₁₄NO₂ Butyric acid, β -(ethylimino)-, ethyl ester, 2876⁷.
- Tropine, N-oxide, and HCl, 384⁸.
- C₂H₁₄NO₂ Butyric acid, β -acetamido-, ethyl ester, 2876⁷.
- Oxamic acid, diethyl-, ethyl ester, 2888⁸.
- C₂H₁₄NO₄ Aspartic acid, di-Et ester, 1798⁸.
- C₂H₁₄NO₄S Tropine, N-sulfonated ether, 384⁸.
- C₂H₁₄NO₅ Epiglucoamine, acetate, 570⁸.
- C₂H₁₄N₃ s - Triazole, 3,5 - diisopropyl-, 3201¹.
- C₂H₁₄N₂O Δ^4 - 2 - Pentenone, 3 - ethyl-, semicarbazone, 2240⁸.
- C₂H₁₄N₂O₂ 1,3,5,4 - Oxidiazin - 4 - one, 2 - ethyltetrahydro - 3,5 - dimethyl - 6 - methylimino-, 2131⁸.

- C₂H₁₁N₃O₄** Glycine, *N* - (alanylalanyl)-, 97⁸.
Glycine, *N* - [*N* - (*N* - methylalanyl)glycyl]-, 100⁴.
- C₂H₁₁** Cyclohexane, dimethyl-, 645⁸, 3047⁴.
Octene, 1735⁸, 3047⁴.
- C₂H₁₁BrNO** Isocaproamide, α -bromo-*N*-ethyl-, 1657⁸.
Propionamide, α - bromo - *N* - isoamyl-, 1657⁷.
- C₂H₁₁BrNO₂** 4 - Carboxy - 1,1,2 - trimethyl-
pyrrolidinium bromide, 1813¹.
- C₂H₁₁Br₂** Octane, 1,7-dibromo-, 3350¹.
- C₂H₁₁Br₂O₂Pb** Triethyllead dibromoacetate, 1445⁸.
- C₂H₁₁ClNO** Octane, 2-chloro-2-nitroso-, 2872⁸.
- C₂H₁₁ClNO₂** Octane, 2 - chloro - 2 - nitro-, 2872⁸.
- C₂H₁₁Cl₂O₂Pb** Triethyllead dichloroacetate, 1445⁸.
- C₂H₁₁N₂** Acetaldehyde, cyclohexylhydrazone, -HCl, 1802².
- C₂H₁₁N₂O** Acetic acid, cyclohexylhydrazide, 1802².
- C₂H₁₁N₂O₂** Acetamide, *N*, *N'* - 2,3 - butylenebis-, 2120¹.
Adipamide, α , γ - dimethyl⁸, 230⁸.
Isopropionamide, α - acetamido-, 61⁸.
- C₂H₁₁N₂O₂** Butyric acid, α - (α - aminoisobutylamino)-, 1966⁸.
Glycine, *N*-leucyl-, 567⁸.
Leucine, *N*-glycyl-, 567⁸.
- C₂H₁₁N₂O₂** Biurea, α -cyclohexyl-, 1802².
1,2 - Cyclohexanedicarboxylic acid, dihydrazide, 590⁸.
- C₂H₁₁N₂O₂** Arginine, acetyl-, 390⁸.
- C₂H₁₁N₂O₂** Guanidine, vanadylmalonate, 2230⁷.
- C₂H₁₁O** Cyclohexanol, dimethyl-, 374^{2,3,6,7,8}.
Cyclohexanol, 2-ethyl-, 374².
 Δ^4 - 3 - Heptenol, 3 - methyl-, 732⁸.
2-Octanone, 3043⁴.
Pentanol, cyclopropyl-, 2666⁸.
- C₂H₁₁OS** Propionic acid, thiono-, Am ester, 2458⁸.
- C₂H₁₁O₂** Caproic acid, Et ester, 1453⁸.
Caprylic acid, 2409⁸.
1,2 - Cyclohexanedicarbinol, 590⁸.
Hexenediol, dimethyl-, 3534⁸.
Isocaproic acid, α , α -dimethyl-, 1796⁷.
Pentanol, methyl-, acetate, 1581¹.
2 - Pentanone, 4 - ethoxy - 4 - methyl-, 892⁷.
- C₂H₁₁O₂** Valeric acid, α -ethyl- β -hydroxy β -methyl-, 3187⁸.
- C₂H₁₁O₂** Fructoside, γ -ethyl-, 2880².
d-Glucose, dimethyl-, 226⁴.
- C₂H₁₁Se₂** 2 - Butanone, 2 - seleno-, dimer, 1963⁸.
- C₂H₁₁AuBr₂OS** Thiophene, tetrahydro-, 1- δ - hydroxybutyl bromoaurate, 1639⁸.
- C₂H₁₁BrO** 2-Octanol, 3-bromo-, 3043⁴.
- C₂H₁₁BrOS** Thiophene, tetrahydro-, 1- δ -hydroxybutyl bromide, 1639⁸.
- C₂H₁₁BrO₂Pb** Triethyllead bromoacetate, 1445⁸.
- C₂H₁₁ClO₂** 2 - Propanol, 1 - chloro - 3 - isomaxo-, 567².
- C₂H₁₁ClO₂Pb** Triethyllead chloroacetate, 1445⁸.
- C₂H₁₁N** (See also *Conine*.)
Cyclohexylamine, 3,5-dimethyl-, and -HCl, 230^{8,9}.
- C₂H₁₁NO** Caproamide, α , α -dimethyl-, 1796⁸.
Cyclohexanol, 4 - (β - aminomethyl)-, and salts, 1805⁸.
Isocaproamide, α , α - dimethyl-, 1796⁷.
1 - Piperidinepropanol, and -HCl, 1977⁸.
- C₂H₁₁NO₂** Butyric acid, β - ethylamino-, ethyl ester, and -HCl, 2876⁷.
Ethanol, 2 - diethylamino-, acetate, and chloroplatinate, 2248⁸.
2 - Pentanone, 4 - ethoxy - 4 - methyl-, oxime, 892⁷.
- C₂H₁₁O₂P** Acetic acid, phosphono-, tri-Et ester, 1627⁷.
- C₂H₁₂** (See also *lance*.)
Hexane, 2,5-dimethyl-, 889⁸, 1576⁸, 3496².
- C₂H₁₂BrN** Butylamine, δ -bromo-*N*, *N*-diethyl-, and -HBr, 3355⁸.
- C₂H₁₂CrN₄S₄**, 1587⁸.
- C₂H₁₂N₂O** Isocaproamide, α -amino-*N*-ethyl-, and salts, 1657⁸.
Propionamide, α -amino-*N*-isoamyl-, 1657⁷.
- C₂H₁₂N₂O₂** 2,3 - Butanediamine, succinate, 2120¹.
- C₂H₁₂N₂S** Pseudourea, α , α , β - triethyl - γ -methylthio-, 2878⁷.
- C₂H₁₂N₂O₂** Adipic acid, α , γ - dimethyl-, dihydrazide, 230⁸.
- C₂H₁₂O** Butyl ether, P 104⁸.
Octyl alcohol, 3551⁸.
3 Pentanol, 2,3,4-trimethyl-, 892⁴.
- C₂H₁₂O₂** Caproaldehyde, di-Me acetal, 55⁸.
3,5-Heptanediol, 3-methyl-, 732⁸.
3-ilexanol, 6-ethoxy-, 731².
2 Pentanol, ethoxymethyl-, 731², 892⁸.
- C₂H₁₂O₂Pb** Triethyllead acetate, 1445⁸.
- C₂H₁₂O₂** 2 - Propanol, 1,1' - oxybis[2 - methyl-, 2459¹].
- C₂H₁₂N** Dibutylamine, 2659⁸.
Diisobutylamine, 2659⁸.
- C₂H₁₂NO** 1 - Butanol, 3 - amino - 2,2 - diethyl-, and salts, 3347⁸.
Isobutylamine, β -(ethoxymethyl)- α -methyl-, 3347⁸.
2 - Propanol, 1 - diethylamino - 2 - methyl-, and chloroplatinate, 2248^{7,8}.
- C₂H₁₂NO₂** Ethanol, 2 - [β - (β - dimethylamino-ethoxy)ethoxy]-, -HCl, 3889⁸.
- C₂H₁₂N₃** Guanidine, α , α - diethyl - β , γ , γ - trimethyl-, 2879¹.
- C₂H₂₀AuS₄**, 3495⁸.
- C₂H₂₀BF₄N₄** Tetraethylammonium fluoborate, 1070⁴.
- C₂H₂₀ClN** Tetraethylammonium chloride, 1397².
- C₂H₂₀ClNO₄** Tetraethylammonium perchlorate, 1397².
- C₂H₂₀Cl₂N₂** 1,1,4,4 - Tetramethylpiperazinium dichloride, 400⁸.
- C₂H₂₀IN** Tetraethylammonium iodide, 801², 1397².
- C₂H₂₀INO** (Ethoxymethyl)diethylmethylammonium iodide, 2660².
(Isobutoxymethyl)trimethylammonium iodide, 2660².
- C₂H₂₀N₂** Piperazine, 1,4-bis(β -aminomethyl)-, 566⁸.
- C₂H₂₀Pb** See *Plumbane*, tetraethyl-.
- C₂H₂₁Cl₂NPTs**, 2856¹.
- C₂H₂₁NO** Tetraethylammonium hydroxide, 1581².
- C₂H₂₁NO₂** (Ethoxymethyl)diethylmethylammonium hydroxide, 2660¹.
- C₂H₂₂Cl₂N₂** Ethylenebis[trimethylammonium chloride], 2459¹.
- C₂H₂₂As₂CoCl₆**, 3571⁸.
- C₂H₂₂As₂I₂Sn**, 3571⁴.
- C₂H₂₄Cl₂N₂Pt**, 3500⁸.
- C₂H₂₄CrN₄O₁₀**, 1601¹.

- C₂H₂N₂O₄** Tetramethylammonium tetroxide, 1627².
- C₂H₂Cl₂N₂Pt**, 2855⁹.
- C₂H₂CuN₂O₄** + 2H₂O Guanidinium cupri-biuret, 866⁹.
- C₂H₂FeCl₂N₂** Dimethylammonium heptachloroferrate, 711¹.
- Ethylammonium heptachloroferrate, 711².
- C₂K** Potassium carbide, 1582⁹.
- C₂Rb** Rubidium carbide, 1583¹.
- C₂Fe₂O₂** Iron carbonyl, 3169⁹.
- C₂GdHg₂N₂S₂** + 12H₂O Compd. of Gd(SCN)₂ and Hg(CN)₂, 365⁹.
- C₂H₂Cl₂N₂** 3-Naphthyridinenitrile, 2,4-dichloro-, 3203⁹.
- C₂H₂Br₂O₂** 1,3 - Indandione, 2,2 - dibromo-, 52².
- C₂H₂Cl₂N** Quinoline, trichloro-, 2475³.
- C₂H₂Cl₂N₂O** Isoindazole, 6 - nitro - 1 - trichloro-acetyl-, 1120¹.
- C₂H₂AgN₂O₂** 1,2,4 - Oxadiazol - 3 - ol, 5 - benzoyl-, Ag deriv., 240⁹.
- C₂H₂Br₂ClO** Salicyllyl chloride, 3,5-dibromo-, acetate, 1120⁹.
- C₂H₂Br₂NO₂** Salicylonitrile, 3,5-dibromo-, acetate, 92¹.
- C₂H₂Br₂NO₂** Isocyanic acid, 3,5-dibromosalicyl ester, acetate, 1120⁹.
- C₂H₂Br₂N₂O** Salicyllyl azide, 3,5-dibromo-, acetate, 1120⁹.
- C₂H₂ClNO** Cinnamyl chloride, *p*-nitro-, 2893⁴.
- C₂H₂ClN₂O** 4 - Isoimidazol - 4 - one, 5 - chloro-2-phenyl-, 3613⁸.
- C₂H₂ClN₂O** 4,7 - Isoindazoleione, 5 - chloro-6-hydroxy-, acetate, 2693⁷.
- C₂H₂Cl₂N₂O** Isoindazole, 1-dichloroacetyl-6-nitro-, 1120¹.
- C₂H₂Cl₂O** 1,3 - Benzodioxan - 4 - one, 2 - (trichloromethyl)-, 1962⁸.
- C₂H₂IN₂O** 8 - Quinolinol, 7 - iodo - 5 - nitro-, 1461⁴.
- C₂H₂KN₂O** 1,2,4 - Oxadiazol - 3 - ol, 5 - benzoyl-, K deriv., 240⁹.
- C₂H₂N₂O** Quinolinedione, 1166¹.
- C₂H₂N₂NaO** 1,2,4 - Oxidiazolol, benzoyl-, Na deriv., 240^{2,5}.
- C₂H₂N₂OS** 3 - Oxidiazinoindolemercaptan, 3199⁵.
- C₂H₂AgNO** 1,3,2 - Benzoxazine - 2,4(3) - dione, 7(and 8) - methyl-, Ag deriv., 1269⁹.
- C₂H₂AsCl₂N** Quinoline, 8 - dichloroarsenyl-, -HCl, 2695⁴.
- C₂H₂AsNO** Quinoline, 8-arsinoso-, -HCl, 2695⁴.
- C₂H₂BrNO** Cinnamic acid, 4 - bromo - 2(and 3) - nitro-, 399^{9,8}.
- C₂H₂BrN₂O** Isoindazole, 1 - acetyl - 3 - bromo-6-nitro-, 1120¹.
- C₂H₂Br₂NOS** Acetanilide, 2,6-dibromo-4-thiocyano-, 1638⁹.
- C₂H₂Br₂N₂O** Indan, 4,6 - dibromo - 5,7 - di-nitro-, 85⁴.
- C₂H₂ClNO** Quinoline, chloro-, and salts, 947⁸.
- C₂H₂ClNO** Cinnamic acid, 4-chloro-2(and 3) - nitro-, 399^{9,8}.
- C₂H₂ClN₂O** Isoindazole, 1-chloroacetyl-6-nitro-, 1120¹.
- C₂H₂Cl₂N** Naphthyridine, 2,7-dichloro-4-methyl-, 586⁴.
- C₂H₂Cl₂N₂O** 4,5 - Benzimidazoleione, 6,7-dichloro-1,2-dimethyl-, 2691⁷.
- 5 - Benzimidazolol, 4,6 - dichloro-, acetate, 2691⁹.
- C₂H₂Cl₂O** Benzoic acid, 3-dichloroacetyl-4-hydroxy-, 1980⁹.
- C₂H₂Cl₂NO** Benzoxazine, trichloromethyl-, 1867¹.
- C₂H₂Cl₂N₂O** 5,6 - Benzimidazoleione, 4,4,7,7-tetrachloro - 4,7 - dihydro - 1,2 - dimethyl-, -HCl, 2691⁷.
- C₂H₂INO** 8-Quinolinol, 5-iodo-, 1461⁴.
- C₂H₂INO₂** See *Yalren*.
- C₂H₂KNO** 1,3,2 - Benzoxazine - 2,4(3) - dione, 7(and 8) - methyl-, K deriv., 1269⁹.
- C₂H₂N₂OS** 3(2) - Benzimidazothiazolone, 245⁹.
- C₂H₂N₂O** 4,5 - Imidazoleione, 2-phenyl-, 3613⁸.
- C₂H₂N₂O** 1,2,4 - Oxidiazolol, benzoyl-, 240².
- C₂H₂N₂O** 5 - Benzisoxazolol, 4 - nitro-, acetate, 3363⁸.
- C₂H₂N₂S** Urea (2,5 - dicyanophenyl)thio-, 1637⁸.
- C₂H₂N₂S** Ditetrazolonaphthyridine, 5 - methyl-, 586⁷.
- C₂H₂O** (See also *Coumarin*.)
- 1,3-Indandione, 3202^{7,9}.
- C₂H₂O** Coumarilic acid, 911⁸.
- Umbelliferone, 215¹.
- C₂H₂O** (See also *Ninhhydrin*.)
- 2,2' - Bis[furan] - 3 - carboxylic acid, 3362⁸.
- Phthalide, 3,4-methylenedioxy, 588⁸.
- C₂H₂O** 1 - Isobenzofuranecarboxylic acid, 1,2-dihydro - 3,4 - dihydroxy - 2 - keto-, 588⁸.
- C₂H₂Br₂N₂O** Indan, 5 - bromo - 4,6 - dinitro-, 85⁴.
- C₂H₂Br₂NO** Salicylaldehyde, 3,5-dibromo-, oxime, acetate, 92¹.
- C₂H₂Br₂N₂O** Ether, β,γ - dibromopropyl picryl, 1096².
- C₂H₂Br₂ClNOS** Benzothiazole, 1 acetamido-5-chloro-, tetrahydride, 2688².
- C₂H₂ClN₂O** Acetanilide, α chloro-*o*-cyano-, 1119³.
- Indazole, 2 acetyl 1 chloro, 1119⁸.
- Isoindazole, 1-acetyl-4-chloro-, 1119⁸.
- C₂H₂ClN₂OS** Benzothiazole, 1 - acetamido - 5-chloro, 2688².
- C₂H₂ClO** Benzaldehyde, 2 chloro-4 hydroxy-, acetate, 3189⁹.
- C₂H₂Cl₂NO** Hydrocarbostyryl, dichloro-, 1979⁷.
- C₂H₂Cl₂N** Acetimidyl chloride, *N*-benzyl-α-trichloro, 2876¹.
- Acetimidyl chloride, α trichloro *N*-*p*-tolyl-, 2875⁸.
- C₂H₂FO₂S** Salicylic acid, 5-(fluorosulfonyl)-, acetate, 3605⁹.
- C₂H₂IN₂O** 8 - Quinolinol, 5 - amino - 7 - iodo-, and -HCl, 1461⁴.
- C₂H₂KN₂O** Hydantoin, 1-phenyl-, K deriv., 1795⁴.
- C₂H₂N** See *Isoquinoline*, *Quinoline*.
- C₂H₂NO** Acetonitrile, benzoyl-, 378⁷, 2902⁴.
- Indolealdehyde, 86⁹, 3185⁸.
- Isoquinoline, *N*-oxide, and -HCl, 94⁷.
- Isoxazole, 4-phenyl, 2259⁶.
- Propiolanilide, 55⁴.
- Quinoline, *N*-oxide, and -HCl, 94⁷.
- Quinolinol, 1⁹ 301⁴, 1237², 1778⁸, 2444⁷, 2449¹.
- C₂H₂NO** Acetophenone, *p* - isothiocyano-, 1637⁷.
- C₂H₂NO** Indolecarboxylic acid, 414², 1308⁴.
- 1,3(2,4) - Isoquinolinedione, 2877⁷.
- Pseudoisatin, 1-methyl-, 2126⁹.
- 2,4 - Quinolinediol, 2475⁴.
- C₂H₂NO** Benzisoxazolol, acetate, 1120⁷, 3363⁸.
- 1,2 - Benzofurandione, 4(5 and 6) - methyl-, 1-oxime, 1269⁹.

- 1,3,2 - Benzoxazine - 2,4(3) - dione, 6(7 and 8)-methyl-, 1269³,⁴.
 Isocyanic acid, salicyl ester, acetate, 1120⁷.
C₆H₇NO₄ Cinnamic acid, *o*-nitro-, 3901¹.
 2 - Indolecarboxylic acid, 5,6 - dihydroxy-, 1994⁵.
 2 - Pseudoindolecarboxylic acid, 3 - hydroxy-(?), *N*-oxide, 3901².
C₆H₇NO₅S 5 - Quinolinesulfonic acid, 7,8 - dihydroxy-, 1401⁴.
C₆H₇NO₅S₂ Quinolinedisulfonic acid, hydroxy-, *Sb* deriv., P 987⁴.
C₆H₇NS₂ Indolecarboxylic acid, dithio-, *salts*, 1459⁹.
C₆H₇N₂NaO₂ 2,7-Naphthyridinediol, 4-methyl-, *Na* deriv., 586⁶.
C₆H₇N₂O₂ Cinnamyl azide, 3900⁷.
C₆H₇N₂O₃ 4,5 - Pyrazoledione, 3 - phenyl, 4-oxime, 1099⁸.
 1,2,5 - Triazole - 1 - *p* - benzoic acid, 2690⁵.
C₆H₇N₂O₃ Indazole, acetylnitro-, 1120³.
 3 - Naphthyridinecarboxamide, 2,4 - dihydroxy-, 3203⁹.
 Salicylyl azide, acetate, 1120⁶.
C₆H₇N₂O₄ 5 - Benzimidazolecarboxylic acid, 2-methyl-7-nitro-, 1813⁸.
 1 - Isoindazolecarboxylic acid, 6 - nitro-, *Me* ester, 1119⁹.
C₆H₇N₂O₇ Ether, allyl picryl, 1096².
C₆H₇N₃ *as* - Triazino[6,5- β]indole, 3 - amino-, 3201².
C₆H₈ Benzene, propargyl-, 738⁴, 2465⁹.
 Indene, 1735⁵, 2471².
C₆H₈AN Quinoline, 8-arsyl-, 2695⁸.
C₆H₈AN₂O₃ 5 - Isoquinolinearsonic acid(?), 2695⁹.
 Quinolinearsonic acid, 2695⁷,⁸.
C₆H₈AN₂O₄ 6 - Quinolinearsonic acid, 2 - hydroxy-, 2695⁹.
C₆H₈BrNO₂ Benzoxazole, 4 - bromo - 5 - methoxy - 1 - methyl-, 3363³.
C₆H₈Br₂ Indan, 4,6-dibromo-, 85².
C₆H₈Br₂INO *p* - Acetotoluide, 2,6 - dibromo-3-iodo-, 2671⁴.
C₆H₈ClNO Cinnamohydroxamyl chloride, 1107³.
 Hydrocarbostyryl, chloro-, 1979⁷,⁸.
C₆H₈ClNO₂S *m* - Benzenesulfonyl chloride, 6-hydroxy - 5 - nitro, acetate, 3897².
C₆H₈ClN₂ 5 - Pyrazolone, 1 - (6 - chloro - 3-pyridyl) - 3 - methyl-(?), 1814⁷.
C₆H₈ClN₂O Indazole, 6-acetamido-7-chloro-, 2693⁸.
C₆H₈Cl₂N₂O₂ 5,6 - Benzimidazole diol, 4,7 - dichloro - 1,2 - dimethyl-, *and* - *HCl*, 2691⁷.
C₆H₈Cl₂O Phenol, 2,4 - dichloro - 6 - propenyl-, 72².
C₆H₈Cl₂O₂S *m* - Benzenedisulfonyl chloride, 2 hydroxy - 5 - methyl-, acetate, 3897².
C₆H₈Cl₂N Acetimidyl chloride, *N*-benzyl- α , α -dichloro-, 2876¹.
 Acetimidyl chloride, α , α -dichloro-*N*-*p*-tolyl-, 2875⁸.
 * Propionimidyl chloride, α , α -dichloro-*N*-phenyl-, 2875⁸.
C₆H₈Cl₂NO Acetamide, *N* - benzyl - α - trichloro-, 2876¹.
 Propionanilide, β ,2,4 - trichloro-, 1979⁶.
C₆H₈Cl₂NO Salicylamide, trichlorohydroxyethyl-, 1866⁹.
C₆H₈INO₂ Benzoic acid, 3-acetamido-4-hydroxy-5-iodo-, 70⁴.
 Benzoic acid, *p*-nitro-, β -iodoethyl ester, 2249¹.
C₆H₈INO *o* - Acetotoluide, 3,4,5 - trilo-911¹.
C₆H₈N₂ Pyridine, 2-pyrryl-, 406³,⁴, 3362²,³.
C₆H₈N₂O 3 - Indolealdehyde, oxime, 87¹.
 Pyrrole, 1,1' - carbonylbis-, 1648⁸.
 8 - Quinololinol, 7-amino-, *and* - *HCl*, 1461⁴.
C₆H₈N₂OS Acetanilide, *p*-thiocyano-, 1638¹.
 Benzisothiazole, 4 - acetamido-, 2692².
C₆H₈N₂O₂ 4,5 - Benzooct - 1,2,6 - oxadiazine, 7-hydroxy-, 1119⁷.
 Carbanilic acid, *o*-cyano-, *Me* ester, 1119¹.
 1,2,3,6 - Dioxiazine, 4-*p*-tolyl-, 1977⁴.
 3 - Furazanol, 4-*p*-tolyl-, 733⁹.
 2,7-Naphthyridinediol, 4-methyl-, 586⁶.
 1,2,4 - Oxidazole, 3 - methoxy - 5 - phenyl-, 1976⁶.
C₆H₈N₂O₂ Benzisoxazole, dimethylnitro-, 92², 3363³.
 2,4 - Xylonitrile, 6 - hydroxy - 3 - nitro-, 3363³.
C₆H₈N₂O₂S Isothiocyanic acid, 2-nitro-*p*-phenylester, 1637⁷.
C₆H₈N₂O₃ Barbituric acid, 5 - (2-furylmethyl)-, 2251⁵.
 Benzoxazole, 5 - methoxy - 1 - methyl - 4-nitro-, 3364¹.
 Methazonic acid, β - benzoyl-, *and* *Cu* salt, 2402⁴,⁵.
C₆H₈N₂O₃S 5 - Quinolinesulfonic acid, 7 - amino-8-hydroxy-, 1461⁴.
C₆H₈N₂O₃ Piperonal, 6-nitro-, methyloximes, *and* - *HCl*, 742⁴,⁵.
C₆H₈N₂O₇ Anisic acid, 2,3 - dinitro-, *Me* ester, 1971².
 Guaiacol, dinitro-, acetate, 376³,⁸.
C₆H₈N₂O₂ Pseudoisatin, semicarbazone, 912¹.
C₆H₈N₂O₃ 1,2,3 - Benzotriazine - 3(4) - carbamic acid, 4-keto-, *Me* ester, 2697⁴.
 1,2,3 - Benzotriazole - 5 - carboxylic acid, 7-acetamido-, 1813⁸.
C₆H₈N₂O₄ Benzimidazole, 1,2-dimethyl-4,5-(*and* 5,6)-dinitro-, 2691⁴.
C₆H₈O Cinnamaldehyde, 576², 3047⁵, 3185⁶, 3888³.
 2-Indanone, 2268³.
C₆H₈O₂ (See also *Cinnamic acid*.)
 2(1) - Benzofur none, methyl-, 1269², 1678⁷.
 α - Toluolaldehyde, α - (hydroxymethylene)-, 2259⁴.
C₆H₈O₃ Acetophenone, 3,4 - methylenedioxy-, 3350⁷.
 Hydrocoumarin, 6-hydroxy-, 2260⁸.
 Umbelliferone, 3,4-dihydro-, 2260⁴.
C₆H₈O₄ (See also *Acetylsalicylic acid*.)
 Benzoic acid, 3-acetyl-4-hydroxy-, 1980⁶.
 Phthalic acid, mono-*Me* ester, 740⁹.
 Protocatechualdehyde, acetate, 1107⁷.
C₆H₈O₃S Cinnamic acid, *o*(*and m*)-sulfo-, *and* salts, 577²,³.
C₆H₈O₄ α , γ - Pentadienic acid, β , δ , δ - trihydroxy-, δ -lactone, diacetate, 1798⁷.
C₆H₈Br₂N 2,4 - Xylencidiazonium fluoborate, 2668⁴.
C₆H₈Br Benzene, γ -bromoallyl-, 2248⁴.
 Indan, 5-bromo-, 85².
 Styrene, β -bromo- α -methyl-, 909⁴.
C₆H₈BrINO *p* - Acetotoluide, 2 - bromo - 5-iodo-, 2671⁴.
C₆H₈BrN Cyanamide, (*p* - bromobenzyl)-methyl-, 53⁹.
C₆H₈BrN₂S Benzothiazole, 5 - bromo - 1 - ethyl-amino-, 584⁴.

- C₂H₅BrO** Chavicol, β -bromo-, 53^o.
Ether, β -bromoallyl phenyl, 53^o.
1-Indanol, 2-bromo-, 2268^o.
- C₂H₅BrO₂** Benzoic acid, bromo-, Et ester, 77^o.
C₂H₅BrO₄ Benzoic acid, 5-bromo-2,4-dimethoxy-, 236^o.
Salicylic acid, 5-bromo-4-methoxy-, Me ester, 236^o.
- C₂H₅Br₂ClN₂S** Benzothiazole, 5-chloro-1-dimethylamino-, dibromide, -HBr, 2688^o.
C₂H₅Br₂N 5-Indanamine, 4,6-dibromo-, 85^o.
C₂H₅Br₂NO₂ Carbanilic acid, 3,5-dibromo-2-hydroxy-, Et ester, 1120^o.
Tyrosine, 3,5-dibromo-, 2260^o.
C₂H₅Br₂N₂O Vanillin, 5,6-dibromo-, semicarbazone, 2258^o.
C₂H₅Br₂N₂S Benzothiazole, 5-bromo-1-ethylamino-, dibromide, 584^o.
Benzothiazoline, 5-bromo-1-(ethylimino)-, dibromide, 584^o.
- C₂H₅Br₃O** Homoveratrole, 3,5,6-tribromo-, 2124^o.
C₂H₅Cl Propene, 3-chloro-1-phenyl-, 2676^o.
C₂H₅ClN₂O Benzisoxazole, 6-amino-3-chloro-2,4-dimethyl-, 3363^o.
C₂H₅ClN₂O₂ Acetanilide, α -chloro-*o*-formyl-, oxime, 1119^o.
C₂H₅ClN₂O Propionanilide, *p*-nitro-, 1979^o.
C₂H₅ClN₂S Benzothiazole, 5-chloro-1-dimethylamino-, 2688^o.
C₂H₅ClN₂O 1,2,3-Benzothiazole, 5-acetamido-4-chloro-1-methyl-, 2690^o.
C₂H₅ClN₂O $\Delta^6(?)$ Isouric acid, 1-acetyl-4-chloro-3,9-dimethyl-, 3352^o.
C₂H₅ClO Acetophenone, chloromethyl-, 2675^o.
C₂H₅ClO₂ Benzoic acid, chloro-, Et ester, 77^o.
C₂H₅ClO₂ Tropic acid, α -chloro-, 3611^o.
C₂H₅Cl₂NO Propionanilide, dichloro-, 1979^o, 2875^o.
C₂H₅Cl₂N₂O₂ Acetyl deriv., m. 99.5^o, of compd from CCl₃CHO and 2-aminopyridine, 94^o.
C₂H₅FO₂S Benzoic acid, (fluorosulfonyl)-, Et ester, 3604^o.
C₂H₅HgNO₂ Benzoic acid, 4-acetamido-3-(hydroxymethyl)-, 70^o.
C₂H₅HgNO₂ Benzoic acid, 3-acetamido-4-hydroxy-5-(hydroxymethyl)-, 70^o.
C₂H₅IO₂ Benzoic acid, *p*-iodo-, Et ester, 77^o.
C₂H₅IO₂ Acetic acid, iodoanisyl-, 1678^o.
C₂H₅I₂NO *p*-Acetotoluide, 2,5-diiodo-, 2671^o.
C₂H₅I₂NO₂ *p*-Acetanilide, 3,5-diiodo-, 912^o.
C₂H₅I₂NO₂ Tyrosine, diiodo-, 1482^o, 1489^o, 1662^o, 2260^o.
C₂H₅N Hydrocinnamonitrile, 1454^o.
Indole, methyl-, 912^o, 913^o, 3226^o.
Skatole, 912^o, 3226^o.
C₂H₅NO Benzisoxazole, dimethyl-, 92^o, 3363^o.
Cinnamaldehyde, oxime, 75^o.
Hydrocarbostyryl, 1979^o.
 Δ^1 -1-Propenol, 3-imino-2-phenyl-, 2259^o.
2,4-Xylonitrile, 6-hydroxy-, 3363^o.
C₂H₅NOS Isothiocyanic acid, *o* (and *m*)-phenetyl ester, 1637^o.
C₂H₅NO Benzisoxazole, 4-methoxy-2-methyl-, 3363^o.
Benzoxazole, 5-methoxy-1-methyl-, 3363^o.
Glyoxal, phenyl-, *O*-methyloxime, 1098^o.
Glyoxylohydroxamaldehyde, *p*-tolyl-, 1977^o.
Hydrocarbostyryl, hydroxy-, 1979^o.
Indan, nitro-, 84^o, 1647^o.
Propiolic acid, PhNH₂ salt, 55^o.
 α -Tolualdehyde, α -(hydroxaminomethyl-ene)-, 2259^o.
C₂H₅NO₂S Hippuric acid, γ -thio-, 98^o.
Isothiocyanic acid, 2,5 (and 3,4)-dimethoxy-phenyl ester, 1637^o.
C₂H₅NO₂ (See also *Hippuric acid*.)
Benzoic acid, acetamido-, 70^o.
Carbanilic acid, *o*-formyl-, Me ester, 1118^o.
Isatic acid, 3-methyl-, 89^o.
Piperonal, methyloximes, and derivs., 74^o, 85^o.
Piperonylamide, *N*-methyl-, 75^o.
Salicylaldehyde, acetyloxime, 921^o.
C₂H₅NO Benzaldehyde, 2-ethoxy-5-nitro-, 233^o.
Benzoic acid, 3-acetamido-4-hydroxy-, Hg(OH)₂ compd., 70^o.
Benzoic acid, nitro-, Et ester, 77^o.
 β -Resorcyllaldehyde, acetyloxime, 3363^o.
Salicylohydroxamic acid, Ac deriv., 1120^o; and *K* salt, 3898^o.
C₂H₅NO₂ Benzoic acid, 2-ethoxy-5-nitro-, and *Na* salt, 233^o.
Benzoic acid, *p*-nitro-, β -hydroxyethyl ester, 2249^o.
Guaiacol, 3-nitro-, acetate, 376^o.
Salicylic acid, 5-nitro-, Et ester, 1108^o.
C₂H₅NO₂ Benzoic acid, 2,4-dimethoxy-3-nitro-, 1971^o.
C₂H₅N₂S Isothiocyanic acid, xylyl ester, 1037^o.
C₂H₅N₂O Indazole, 5-acetamido-, 2693^o.
2(1)-Naphthyridone, 7-amino-4-methyl-, and -HCl, 586^o.
1,3,4-Oxadiazole, 2,3-dihydro-2-imino-5-methyl-3-phenyl-, and -HCl, 913^o.
C₂H₅N₂OS 1,3,4-Thiadiazole-2(3)-one, 5-*p*-toluino-, 2900^o.
C₂H₅N₂O Benzimidazole, 1,2-dimethyl-5-nitro-, 2691^o.
5-Benzimidazolecarboxylic acid, 7-amino-2-methyl-, 1813^o.
Indazole, 2-ethyl-6-nitro-(?), 1120^o.
o-Phenylenesemimalonamide, 2132^o.
C₂H₅N₂O Benzotriazole, 3-amino-6-ethoxy-2-nitro-, 2260^o.
Piperonal, semicarbazone, 68^o.
C₂H₅N₂O Benzoic acid, 3(or 4)-acetamido-4(or 3)-amino-5-nitro-, 1813^o.
Phthalide, 6-hydrazino-5-methoxy-3-nitro-, 3358^o.
C₂H₅N₂S Δ^2 -1,3,4-Thiadiazoline-2-mercaptan, 5-*p*-tolylimino-, 3199^o.
 Δ^1 -1,3,4-Thiadiazoline, 2-methylmercapto-5-phenylimino-, 3199^o.
C₂H₅N Triazolobenzimidazole, 3,5-dihydro-5,6-dimethyl-, 2691^o.
C₂H₅N₂O Pseudoisatin, 6-amino-, semicarbazone, 912^o.
C₂H₅N₂O Benzaldehyde, methoxydinitro-, semicarbazone, 2675^o.
C₂H₅ Indan, 84^o.
Styrene, α -methyl-, 909^o.
C₂H₅AgN₂O₃ 3-Triazencarboxylic acid, 1-phenyl-, ethyl ester, silver deriv., 2903^o.
C₂H₅As₂O₂ Acetic acid, *p*-tolylarseno-, 1628^o.
C₂H₅BrN 5-Indanamine, 6-bromo-, and -HCl, 85^o.
C₂H₅BrNO Homopiperonylamine, 6-bromo-, and salts, 1270^o.
C₂H₅BrNO *p*-Acetanilide, 5-bromo-2-hydroxy-, 3363^o.
Acetophenone, 5-bromo-2-hydroxy-4-methoxy-, oxime, 3363^o.

- C₉H₁₀BrNO₄** Homoveratrole, 5-bromo-3-nitro-, 3607⁹.
- C₉H₁₀BrN₂O₂** Vanillin, bromo-, semicarbazone, 1803⁹, 2258⁹.
- C₉H₁₀Br₂N₂S** Benzothiazole, 1-ethylamino-, dibromide, 584¹.
- Benzothiazole, 1 - dimethylamino-, dibromide, 2688⁸.
- C₉H₁₀Br₂N₂OS** Benzothiazole, 1-amino-5-ethoxy-, tetrabromide, -HBr, 2688⁸.
- C₉H₁₀Br₂N₂S** Benzothiazole, 1-dimethylamino-, tetrabromide, -HBr, 2688⁸.
- C₉H₁₀Br₂N₂S** Benzothiazole, 1-dimethylamino-, hexabromide, 2688⁸.
- C₉H₁₀ClNO** Carbanilyl chloride, *N*,*o*-dimethyl-, 2899⁷.
- Carbanilyl chloride, *N*-ethyl-, 1108⁶.
- Propane, 2 - chloro - 2 - nitroso - 1 - phenyl-, 2872⁹.
- Propionanilide, β -chloro-, 1979⁶.
- C₉H₁₀ClNO₂** *p*-Acetoanilide, α -chloro-, 2256⁸.
- Propane, 2 - chloro - 2 - nitro - 1 - phenyl-, 2873¹.
- Propionanilide, β - chloro - *o*(*m* and *p*) - hydroxy-, 1979⁶.
- C₉H₁₀ClNO₂S** Sulfide, β -chloroethyl *p*-nitrobenzyl-, 3191⁸.
- Sulfide, γ - chloropropyl *p* - nitrophenyl-, 3191⁴.
- C₉H₁₀ClNO₂S** *m* - Toluenesulfonyl chloride, 4-acetamido-, 2344¹.
- C₉H₁₀ClN₂O₂** Anisaldehyde, 2-chloro-, semicarbazone, 3189⁹.
- Benzaldehyde, 4 - chloro - 2 - methoxy-, semicarbazone, 3189⁸.
- C₉H₁₀ClN₂O₂S** Vanillin, chloro-, thiosemicarbazone, 906².
- C₉H₁₀ClN₂O₂** Vanillin, chloro-, semicarbazone, 906².
- C₉H₁₀Cl₂O₂S** *m* - Benzenedisulfonyl chloride, 2,4,6 - trimethyl-, 3604⁷.
- C₉H₁₀Cl₂NO₂** Toluidine, trichloroacetate, 3905⁹.
- C₉H₁₀Cl₂NO₂** Acetic acid, trichloro-, *o*-anisidine salt, 1030².
- C₉H₁₀Cl₂O₂Zr** Addn. compd. from ZrCl₄ and peony oil, 1069⁹.
- C₉H₁₀FNO₂S** Toluenesulfonyl fluoride, acetamido-, 3604⁴.
- C₉H₁₀FNO₂S** Mesitylenesulfonyl fluoride, nitro-, 3604⁷.
- 5 - Pseudocumenesulfonyl fluoride, nitro-, 3604⁷.
- C₉H₁₀HgO₂** *o* - Cresol, 4(and 6) - (acetoxymercuri)-, 1252⁹.
- C₉H₁₀IN₂O₂** 1,2 - Dimethyl - 5 - nitroindazolium iodide, 2693⁴.
- C₉H₁₀N₂** Indole, 3 - (aminomethyl)-, 87¹.
- C₉H₁₀N₂O** 3(1) - Indazolone, 1,7 - dimethyl-, 2899⁸.
- 3(1) - Indazolone, 1 - ethyl-, 2899⁷.
- Propionitrile, α - (*p* - hydroxyanilino)-, 1449⁶.
- Urea, styryl-, 3900⁸.
- C₉H₁₀N₂OS** Benzothiazole, 1-amino-5-ethoxy-, 2688⁸.
- Urea, (*p* - acetylphenyl)thio-, 1637⁸.
- C₉H₁₀N₂O₂** Glyoxime, phenyl-, Me deriv., and -HCl, 1098², 3.
- 5 - Indanamine, 4 - nitro-, 85¹.
- C₉H₁₀N₂O** Carbanilic acid, *o*-formyl-, Me ester, oxime, 1119¹.
- Glyoxylohydroxamic acid, *p*-tolyl-, oxime, 733⁹.
- 2 - Propanone, 1 - amino - 1 - (*o* - nitrophenyl)-, -HCl, 75⁹.
- 1(2) - Pyridinenitrile, 2 - hydroxy-, Et carbonate, 2694¹.
- Urea, anisoyl-, 1866⁹.
- Urea, *o*-methoxybenzoyl-, 1866⁹.
- C₉H₁₀N₂O** Anisaldehyde, 3-nitro-, *O*-methyl-oxime, 74⁷.
- Carbanilic acid, *p*-nitrobenzyl-, Me ester, 1978².
- Hydrocinnamic acid, β -amino-*m*-nitro-, and -HCl, 1257⁴.
- C₉H₁₀N₂O₂** *p* - Acetanilide, 2 - hydroxy - 5-nitro-, 3364¹.
- Acetophenone, 2 - hydroxy - 4 - methoxy-5-nitro-, oxime, 3363⁹.
- C₉H₁₀N₂O₂** Homoveratrole, 3,6 - dinitro-, 3607⁷.
- C₉H₁₀N₂S** Aniline, *p*-isothiocyano-*N*, *N*-dimethyl-, 1637⁷.
- Benzothiazole, 1 - dimethylamino-, 2688⁸.
- 1-ethylamino-, 584¹.
- C₉H₁₀N₂O** 1,2,3 - Benzotriazole, 7 - acetamido-5-methyl-, 1813⁸.
- Carbanilyl azide, *N*,*o*-dimethyl-, 2899⁸.
- , *N*-ethyl-, 2899⁷.
- C₉H₁₀N₂O₂** Benzimidazole, 6-amino-1,2-dimethyl-5-nitro-, 2691⁸.
- C₉H₁₀N₂** Acetonitrile, *N*, *N*' - methylenebis-*iminobis*-, 736⁹.
- C₉H₁₀O** Acetophenone, *p*-methyl-, 1520⁴.
- Ethylene oxide, benzyl-, 3899⁷.
- , α - methyl - α - phenyl-, 2465⁴.
- Hydrocinnamaldehyde, 2530⁴.
- Ketone, benzyl methyl, 2465⁴.
- 2 - Propanone, 1-phenyl-, 80⁸.
- α - Toluinaldehyde, α - methyl-, 2465⁴.
- 2,4-Xylaldehyde, P 1272⁸.
- C₉H₁₀OS** Benzoic acid, thiono-, Et ester, 2458⁸.
- C₉H₁₀OS** Benzoic acid, *p*-hydroxydithio-, Et ester, 3106⁴.
- C₉H₁₀O₂** (See also *Benzoic acid*, ethyl ester.)
- Acetic acid, benzyl ester, 55⁷, 387², 1581¹, 3047⁴.
- Guaicol, 4-vinyl-, 3050¹.
- Hydrocinnamic acid, 2260², 1308², 3020².
- Δ^1 - 3 - Pentenone, 1 - (2 - furyl)-, 86⁹.
- Phthalide, 4,5 - dihydro - 2 - methyl-, 2261¹.
- Propionic acid, phenyl-, 1308⁴.
- Propiophenone, α -hydroxy-, 2289⁸.
- Pyrocatechol, allyl-, 3192⁴.
- Salicylaldehyde, Et lactolide, 1448⁴.
- C₉H₁₀O₂S** Acetic acid, tolylmercapto-, 1096⁷.
- C₉H₁₀O₂S₂** Acetic acid, (methylmercaptophenylmercapto)-, 1096⁷.
- C₉H₁₀O₂Se** Acetic acid, *o*-tolylselenyl-, 1252².
- C₉H₁₀O₂** (See also *Pronol*.)
- Acetic acid, toloxy-, 1096⁶, 1678⁷.
- Acetophenone, 2 - hydroxy - 3 - methoxy-, 2258⁸.
- Anisic acid, Me ester, 1805⁸.
- Benzoic acid, *o*-methoxy-, Me ester, 1805⁸.
- Phloretic acid, 1308⁸.
- Propionic acid, hydroxyphenyl-, 1308⁴.
- Salicylic acid, Et ester, 1805⁸.
- C₉H₁₀S** Acetic acid, (*o* - anisylmercapto)-, 1096⁷.
- C₉H₁₀O₄** Acetic acid, anisylloxy-, 1096⁶, 1678⁹.
- Hydrocaffeic acid, 3068⁹.
- Tropic acid, α -hydroxy-, 3611⁸.
- Veratraldehyde, 5 - hydroxy-, 78⁹.
- C₉H₁₀O₄** Glutaric acid, α - (α - hydroxyethylidene) - β - keto-, lactone, Et ester, 2462⁴.
- C₉H₁₀S₂** Benzoic acid, dithio-, Et ester, 3609².

- C₉H₁₁AsBrNO₄** Arsanic acid, *N* - (α - bromopropionyl)-, 71¹.
- C₉H₁₁AsN₂O₄** Carbamic acid, [(*p* - arsonophenyl)carbanylmethyl]-, 70⁹.
- C₉H₁₁Br** Benzene, (α - bromopropyl)-, 563⁸.
Toluene, *o* (*m* and *p*) - (β - bromoethyl)-, 3608¹.
- C₉H₁₁BrN₂S** Urea, α - (*p* - bromophenyl) - β -ethylthio-, 584⁴.
- C₉H₁₁BrO₂** Homoveratrole, 5-bromo-, 3607⁸.
- C₉H₁₁Cl** Benzene, (γ -chloropropyl)-, 1454¹.
- C₉H₁₁ClN₂S** Urea, β - (*p* - chlorophenyl) - α , α -dimethylthio-, 2688⁸.
- C₉H₁₁ClN₂O₂** Uric acid, 4 - chloro - 4,5 - dihydro - 5 - hydroxy - 3,9 - dimethyl-, acetate, 3352⁴.
- C₉H₁₁ClO₂** Homoveratrole, 5-chloro-, 3607⁸.
- C₉H₁₁ClO₂S** α - Toluenesulfonyl chloride, α -ethyl-, 2673⁸.
- C₉H₁₁ClS** Sulfide, γ - chloropropyl phenyl, 3191⁴.
- C₉H₁₁Cl₂NO₂** Acetic acid, dichloro, *o*-anisidine salt, 1630².
- C₉H₁₁FO₂S** Mesitylenesulfonyl fluoride, 3604⁷.
5 - Pseudocumenesulfonyl fluoride, 3604⁷.
- C₉H₁₁IO** Phenetole, δ -iodo-, 1639².
- C₉H₁₁N** Indanamine, 84⁸, 1047⁹.
Indoline, 7-methyl-, and -HCl, 912⁷.
Isoquinoline, 1,2,3,4 - tetrahydro-, 1460⁷, 2696⁴.
Quinoline, tetrahydro-, 2696⁸, 3055⁷.
- C₉H₁₁NO** (See also *Exalgene*.)
Acetamide, *N*-benzyl-, 73⁷, 75⁷, 895⁸.
Acetotoluide, 395¹, 2884³.
Aniline, *N* - ($\beta\gamma$ - epoxypropyl)-, 2461³.
Benzaldehyde, *p*-dimethylamino-, 1107⁵.
p-Cresol, 2- α -iminoethyl-, 3363³.
Propionanilide, 3355².
- C₉H₁₁NO₂** *o* - Acetotoluide, 4 - mercapto -, 231⁵.
- C₉H₁₁NO₂** (See also *Benzocaine*.)
Alanine, phenyl, 61¹, 950¹, 1661⁹, 1932¹, 2725¹, 2933⁹.
Anisaldehyde, methyloximes, and -HCl, 74^{4,9}.
Anisamide, *N* methyl-, 75¹.
Anthranilic acid, *N*, *N*-dimethyl-, 2848².
Benzaldehyde, methoxy-, methyloximes, and *derivs.*, 74^{2,4,5,8,9}.
Benzoic acid, *m*-amino-, Et ester, 77⁸.
—, *p*-dimethylamino-, 1797².
Carbamic acid, methylbenzyl ester, P 3425².
Carbanilic acid, ethyl ester, 2430⁸.
Cumene, α -nitro-, 73⁸.
Homopiperonylamine, 2669¹.
Hydrocinnamic acid, β -amino-, and -HCl, 1257⁴.
Lactanilide, 1678⁸.
Nicotinic acid, 6-propyl-, and salts, 2130⁸.
Phenol, *p* - methylamino-, acetate, and -HCl, 2886².
 Δ^1 - 1,3 - Propenediol, 3 - amino - 2 - phenyl-, 2259⁸.
2,4 - Xylaldehyde, 6 - hydroxy-, oxime, 3363³.
- C₉H₁₁NO₂** (See also *Tyrosine*.)
p - Acetanilide, 2 - hydroxy-, 3363⁸.
Acetophenone, 2 - hydroxy - 4 (and 5) - methoxy-, oxime, 3363^{7,8}.
Anthranilic acid, *N* - β - hydroxyethyl-, 2467⁸.
Benzoic acid, *p* - (β - hydroxyethylamino)-, 2467⁹.
- Glycine, *N* - (*p* - hydroxyphenyl)-, Me ester, 1794⁴.
3 - Pyrrolecarboxylic acid, 5 - formyl - 2-methyl-, Et ester, 381¹.
3 - Pyrrolepropionic acid, 5 - formyl - 4-methyl-, 1658².
Tropic acid, α -amino-, and -HCl, 3611⁸.
- C₉H₁₁NO₂S** Acetanilide, *p* - (methylsulfonyl)-, 234⁴.
2 - Benzenesulfonazolo, 2 - ethyl - 1,2 - dihydro-, 3202².
Ethanol, 2 - (*p* - nitrobenzylmercapto)-, 3191³.
1 - Propanol, 3 - (*p* - nitrophenylmercapto)-, 3191⁴.
m - Toluenesulfinic acid, 4 - acetamido-, 234⁴.
- C₉H₁₁NO₄** Alanine, dihydroxyphenyl-, 420⁷, 145¹⁹, 2285², 2337³, 2435¹, 2487³, 3684⁴.
Toluene, 2,4 - dimethoxy - 5 - nitro-, 1971¹.
- C₉H₁₁NO₅** Benzene, 1,4,5 - trimethoxy - 2-nitro-, 1974⁹.
- C₉H₁₁N₃** Benzimidazole-, aminodimethyl-, 1813⁷, 2691⁷.
- C₉H₁₁N₃O** Cyclopropanecarboxamide, 1,3-dicyano 2 ethyl - 2-methyl-, 2877⁸.
- C₉H₁₁N₃O₂** Anisaldehyde, semicarbazone, 68⁸.
Formaldehyde, β - ethyl - β - (*p* - nitrophenyl)hydrazon-, 1251².
Pyridine, 2,5 - diacetamido-, 1986⁴.
 α - Toluualdehyde, *o* - hydroxy-, semicarbazone, 2875¹.
3 - Triazeneacetic acid, 1 - phenyl-, ethyl ester, 2903⁷.
- C₉H₁₁N₃O₂** Acetophenone, 3,5-dihydroxy-, semicarbazone, 1803⁸.
Acetotoluide, aminonitro-, 1813⁷.
Benzaldehyde, 3 hydroxy-5-methoxy-, semicarbazone, 3356⁷.
Carbazic acid, β - anthranoyl-, Me ester, and -HCl, 2697⁴.
- C₉H₁₁N₃O₂S** Urea, (2-nitro-*p*-phenetyl)thio-, 1637⁸.
- C₉H₁₁N₃O₄** Acetophenone, 3,4,5-trihydroxy-, semicarbazone, 1108¹.
Benzamide, 3 - amino - 6 - ethoxy - 2 - nitro-, 2260⁸.
- C₉H₁₂** (See also *Mesitylene*.)
Benzene, propyl-, 65⁸, 3047⁴.
Cumene, 65⁸, 3047⁴.
Pseudocumene, 738², 3047⁴.
- C₉H₁₂ClN** Benzylamine, *o* - chloro - *N*, *N*-dimethyl-, and -HCl, 54².
- C₉H₁₂ClNO** Ketone, chloromethyl 3,4,5-trimethyl-2-pyrryl-, 85⁸.
- C₉H₁₂ClNO₂** 3 - Carboxy - 1 - β - hydroxyethylpyridinium chloride, Me ester, 1977¹.
- C₉H₁₂Hg** Benzyl ethyl mercury, 233⁸.
- C₉H₁₂IN** Benzylamine, *p* - iodo - *N*, *N* - dimethyl-, 54¹.
- C₉H₁₂INS** Acetanilide, thio-, methiodide, 1101³.
- C₉H₁₂N₂** Benzamidine, *N*, *N*-dimethyl-, 1108⁸.
Naphthridine, tetrahydroethyl-, and chloroplatinate, 586^{2,8}.
Pyridine, 3 - (2 - pyrrolidyl)-, and chloroaurate, 3905^{8,9}.
2 - Pyrrolenitrile, 4 - ethyl - 3,5 - dimethyl-, 2701⁹.
- C₉H₁₂N₂O** Hydrocinnamamide, α -amino-, 378¹.
- C₉H₁₂N₂OS** Urea, *o* (and *m*)-phenetylthio-, 1637⁹.
- C₉H₁₂N₂O₂** (See also *Dulcin*.)
Benzylamine, dimethylnitro-, 73⁷; -HCl, 3614^{7,8}.

- Propylamine, γ - (β - nitrophenyl)-, *salts*, 2254².
- Urea, α - methoxy - β - phenyl-, 2249².
- , α - methoxy - α - methyl - β - phenyl-, 2249².
- C₈H₁₂N₂O₂S** Urea, [2,5 (and 3,4) - dimethoxy-phenyl]thio-, 1637².
- C₈H₁₂N₂O₂** Barbituric acid, allylethyl-, 777².
- Glycine, *N* - 1 - pyrrolyl-, Et ester, 1648².
- 3 - Pyrrolicarboxylic acid, 5 - formyl - 2 - methyl-, Et ester, oxime, 381².
- C₈H₁₂N₂O₂S** α - Toluenesulfonamide, *N*, *N* - dimethyl-*o*-(*m* and *p*)-nitro-, 2254².
- α - Toluenesulfonamide, *N* - ethyl - *o*-(*m* and *p*)-nitro-, 2254².
- C₈H₁₂N₂O₂** 3,5 - Pyrazoledicarboxylic acid, 4 - hydroxy-, di-Et ester, 3903².
- C₈H₁₂N₂O₂** Uridine, 97², 587².
- C₈H₁₂N₂O₂S** Benzaldehyde, nitro-, *N* - methyl-oxime, methosulfate, 74².
- C₈H₁₂N₂S** Urea, thioxyl-, 1637².
- C₈H₁₂N₄** Benzimidazole, 5,6 - diamino - 1,2 - dimethyl-, 2691².
- C₈H₁₂N₄O** Acetophenone, 4 - aminosemicarbazone, 1249¹.
- C₈H₁₂N₄O₂S** Semicarbazide, 1 - (α - nitromethylbenzyl)thio-, 2253².
- C₈H₁₂N₄O₂** Semicarbazide, 1 - (α - nitromethylbenzyl)-, 2253².
- Xanthine, 1 - (methoxymethyl) - 3,7 - di-methyl-, P 918².
- C₈H₁₂N₄** Naphthyridine, 2,7 - dihydrazino-4-methyl-, and *di-HCl*, 589².
- C₈H₁₂O** Benzyl alcohol, α -ethyl-, 72², 2938², 3887².
- Ether, isopropyl phenyl, 3897².
- Phenethyl alcohol, α -methyl-, 2938².
- C₈H₁₂O₂** 3 - Pentanone, luryl-, 86², 1116².
- 1,2 - Propanediol, 2 - phenyl-, 2465².
- C₈H₁₂O₂S** Mesitylene, SO₂ addn. compd., 738².
- Pseudocumene, SO₂ addn. compd., 738².
- C₈H₁₂O₂** Cyclohexaneacetic acid, 2 - carboxy-, anhydride, 587¹.
- 2 - Furanpropanol, acetate, 3053².
- C₈H₁₂O₂S** α - Toluenesulfonic acid, α - ethyl-, 52²; *Na salt*, 2673².
- C₈H₁₂O₂** Δ^1 - Cyclohexenemalononic acid, and *di-Ag salt*, 228².
- Δ^1 - Cyclopentenemalononic acid, α - methyl-, 228¹.
- Spiro[cyclopentane - 1,2' - paraconic acid, and *Ag salt*, 2877²].
- C₈H₁₂O₂** Arabinal, diacetyl-, 2121¹.
- C₈H₁₂O₂** 3,4 - Furanedicarboxylic acid, 2 - ethyl-tetrahydro - 5 - keto - 2 - methyl-, 2877².
- Glutaconic acid, mono-Et ester, acetate, 1798².
- Glutaric acid, α - acetyl - β - keto-, Et ester, 2462².
- C₈H₁₂S** Benzyl mercaptan, α -ethyl-, 52².
- C₈H₁₂AN₂O** Arsanilic acid, *N*-alanlyl-, 71¹.
- C₈H₁₂BrClN** (β - Bromophenyl)trimethylammonium chloride, 394².
- C₈H₁₂BrIN** (β - Bromophenyl)trimethylammonium iodide, 394².
- C₈H₁₂Br₂N** (β - Bromophenyl)trimethylammonium bromide, 394².
- C₈H₁₂ClO** $\Delta^1(\alpha)$ - Cyclopentaneacetyl chloride, α -ethyl-, 3187².
- Δ^1 - Cyclopentaneacetyl chloride, α -ethyl-, 3187².
- C₈H₁₂ClO₂** Succinic acid, α -, (α - chloroethylidene) - β - methyl-, Et ester, 386².
- C₈H₁₂N** Benzylamine, dimethyl-, 73², 1250².
- Benzylamine, α -ethyl-, and -HCl, 8346².
- $\Delta^1(\alpha)$ - Cyclopentaneacetoneitrile, α - ethyl-, 3187².
- Phenethylamine, *N*-methyl-, 1250².
- 2 - Picoline, 5 - isopropyl-, *chloroplatinate*, 2692².
- β - Toluidine, *N*, *N* - dimethyl-, 1106¹.
- C₈H₁₂NO** Cresol, α - dimethylamino-, and -HCl, 3014².
- Ketone, 2,4 - dimethyl - 3 - pyrrolyl ethyl, 382¹.
- , methyl trimethylpyrrolyl, 85², 381².
- C₈H₁₂NO₂** Anthranilic acid, 4,5-dihydro-, *Et ester*, and -HCl, 2408².
- Cyclohexaneacetic acid, 2 - carboxy-, imide, 587¹, 2877².
- 1,1 - Cyclopentanediacetamide, 1968¹.
- 3 - Pyrrolopropionic acid, 4,5 - dimethyl-, 1658².
- Spiro[cyclohexanesuccinimide], 2877².
- m* - Xylorcinol, 5 - methylamino-(?), 2131².
- C₈H₁₂NO₂S** β - Toluenesulfonamide, *N*, *N* - dimethyl-, 3604².
- α - Toluenesulfonamide, *N* - ethyl-, 2254².
- C₈H₁₂NO₂** (See also *Adrenaline*.)
- 3 - Pyrrolicarboxylic acid, 5 - (hydroxymethyl) - 2 - methyl-, Et ester, 381².
- C₈H₁₂NO₂** Fumaric acid, α - propionylamino-(?), di-Me ester, 60².
- Maleic acid, α - propionylamino-(?), di-Me ester, 60².
- C₈H₁₂NO₂S** Benzaldehyde, *N* - methyloxime, methosulfate, 74².
- C₈H₁₂N₂** Quinazoline, 2 - amino - 5,6,7,8 - tetrahydro-4-methyl-, 3198².
- C₈H₁₂N₂O** 4 - Quinazolinol, 2 - amino - 5,6,7,8 - tetrahydro - 7 (and 8)-methyl-, 3198².
- C₈H₁₂N₂O₂** 1,3,5,4 - Oxidiazin - 4 - one, 2 - acetonilydenetetrahydro - 3,5 - dimethyl - 6 - methylimino-, 2131².
- C₈H₁₂N₂O₂** 3,5 - Pyrazoledicarboxylic acid, 4 - amino-, di-Et ester, 3904¹.
- C₈H₁₂N₂S** Urea, (β - dimethylaminophenyl)-thio-, 1637².
- C₈H₁₂** Apocycene, 2679².
- Apoisofenchene, 2679².
- Santene, 237².
- C₈H₁₂AsNO₂** *m* - Arsanilic acid, *N* - (β - hydroxyethyl)-4-methyl-, P 2908².
- Arsanilic acid, *N* - (γ - hydroxypropyl)-, P 2908².
- C₈H₁₂Br₂O₂** Cycloheptaneacetic acid, α ,1 - dibromo-, 3187².
- C₈H₁₂ClNO** See *Sympatol*.
- C₈H₁₂N₂** Toluidine, α - dimethylamino-, and *di-HCl*, 3614².
- C₈H₁₂N₂O₂S** 4 (or 5) - Imidazolecarboxylic acid, 2 - (ethylmercapto) - 5 (or 4) - methyl-, Et ester, 3614².
- C₈H₁₂N₂O₂** 5 - Pyrazolecarboxylic acid, 4 - hydroxy-3-isomyl-, 3903².
- C₈H₁₂N₂O₂** Compd., *m*. 216², from santene, 237².
- C₈H₁₂N₂O₂S** *m* - Benzenedisulfonamide, 2,4,6 - trimethyl-, 3604².
- C₈H₁₂N₂O₂** Carbamic acid, malonylbis-, di-Et ester, 1654².
- C₈H₁₂N₂O** 2 - Pyrrolicarboxylic acid, 3,4,5 - trimethyl-, semicarbazone, 85².
- C₈H₁₂N₂O₂** See *Carnosine*.
- C₈H₁₂N₂O₂** Glycine, *anthonylbis*[glycyl-, 3206².
- C₈H₁₂O** 2-Indanone, *benzylhydro*-, 1112².
- 2 - Propanone, 1 - Δ^1 - cyclohexenyl-, 3186².
- C₈H₁₂O** $\Delta^1(\alpha)$ - Cycloheptaneacetic acid, 3187².

- Δ^1 - Cyclohepteneacetic acid, 3187^a.
 Δ^1 - Cyclohexenecarboxylic acid, Et ester, 586^b.
 $\Delta^1(\alpha)$ - Cyclopentaneacetic acid, α - ethyl-, 3187^a.
 Cyclopenteneacetic acid, α -ethyl-, 901^a, 3187^a.
 Furan, 2 - (butoxymethyl)-, 1648^a.
 —, 2 - (isobutoxymethyl)-, 1648^a.
C₉H₁₄O₃ Cyclobutanecarboxylic acid, 3 - (formylmethyl) - 2,2 - dimethyl-, 2679^b.
 Cyclopentanecarboxylic acid, 2 - keto - 1-methyl-, Et ester, 375^a.
 Δ^2 - 1 - Propenol, 3 - (2,3,4,5 - tetrahydro 2-furyl)-, acetate, 3053^a.
C₉H₁₆O₁ Apofenchocamphoric acid, 2679^a.
 Cyclohexaneacetic acid, 2-carboxy-, 587¹.
 1,1 - Cyclohexanedicarboxylic acid, mono-Me ester, 229^a.
 Cyclohexaneacetic acid, 2-carboxy-, 901^a, 1112^a.
 Cyclopropanedicarboxylic acid, di-Et ester, 1249^a.
 Paraconic acid, 2,2-diethyl-, 2877^a.
 Pseudoarabinal, monoacetyl-, Et cyclo-hemiacetal, 2121^a.
C₉H₁₀O₂ Arabinal, diacetylidihydro-, 2121^a.
C₉H₁₀O₆ Acetin, 557¹.
C₉H₁₄Sn Stannane, trimethylphenyl-, 1973⁷.
C₉H₁₄As Arsine, triallyl-, 3612^a.
C₉H₁₄BrO₂ Cyclopentaneacetic acid, α -bromo-, Et ester, 59^a.
C₉H₁₄ClO $\Delta^1(\alpha)$ - Cyclopentaneacetamide, α -ethyl-, 3187^a.
 α - Hexenyl chloride, β - propyl-, 3187^a.
C₉H₁₄ClO₂ Cyclohexanol, 2-chloro-, propionate, 571^a.
C₉H₁₄ClO₂ 1 - Pentanol, 1 - (trichloromethyl)-, propionate, 1625^a.
 1 - Propanol, 2 - methyl - 1 - (trichloromethyl), butyrate, 1625^a.
C₉H₁₄HgIO Santene, hydroxymercuri, iodide, 237^a.
C₉H₁₄N γ - Pentenonitrile, α,α - diethyl, P 2478^a.
 Pyrrole, isoamyl-, 2151³.
C₉H₁₄NO (See also *Pseudopelletierine*.)
 Δ^1 - Cyclopentaneacetamide, α - ethyl-, 3187^a.
 2 - Indanone, hexahydro-, oxime, 1112^a.
C₉H₁₄NO₂ Δ^3 - Cyclohexenecarboxylic acid, 2-amino-, Et ester, and -HCl, 2468^a.
 Glutarimide, β,β -diethyl-, 1968^a.
 Propionic acid, α - (cyclohexylimino)-, 2876^a.
 Pseudopelletierine, N oxide, and HBr, 384^a.
C₉H₁₄NO₂ (See also *Egonine*.)
 Cyclohexanecarboxylic acid, 1 - carbamyl-, Me ester, 229^a.
C₉H₁₄NO₄ Glycine, N - (o-carboxycyclohexyl)-, and salts, 245^a.
C₉H₁₄NO₄S Butylsulfuric acid, pyridine salt, 53^a.
 Ethylsulfuric acid, benzylamine salt, 53^a; N-methylaniline salt, 53^a.
 Propylsulfuric acid, PhNH₂ salt, 53^a.
C₉H₁₄NO₄ Aspartic acid, N - propionyl-, di Me ester, 61^a.
C₉H₁₄N₂O Cyclopentanone, 2 - isopropylidene, semicarbazone, 1103^a.
C₉H₁₄N₂O₂ Pyrimidine, 2,4-diethoxy-6-methyl-amino-, 2271⁷.
C₉H₁₄N₂O₂S (See also *Thioneine*.)
 Ergothioneine, 915^a.
 Sympectothione, 915^a.
 Thiasine, 915^a.
C₉H₁₆ Cyclohexane, 1,1-dimethyl-3-methylene-, 737^a.
 Heptadiene, dimethyl-, 50^a, 733¹.
 Indan, hexahydro-, 2890⁴.
C₉H₁₆ClNO Cyclohexanecarboxamide, 1-chloro-N-ethyl-, 2875^a.
C₉H₁₆INO₂ Pseudoscopine, methiodide, 3365^a.
C₉H₁₆N₂ 1 - Piperidinebutyronitrile, 2271¹.
C₉H₁₆N₂O₂ 2,5 - Piperazineidone, 3 - amyl-, 1965^a.
 2,5 - Piperazineidone, 3 - isopropyl - 1,4-dimethyl-, 100^a.
 Piperidone, tetramethylnitroso-, 2591^a.
C₉H₁₆N₂O₂ Compd., m. 87-88°, from santene, 237^a.
C₉H₁₆N₂O₃ Hydrouacil, 5,5,6 - trimethoxy-1,3-dimethyl-, 1447⁷.
C₉H₁₆N₂O₄V Propylenediamine, vanadylmalonate, 2230⁷.
C₉H₁₆O Cyclohexanone, 2 - ethyl - 2 (and 6)-methyl-, 2465^a.
 Cyclohexanone, 2-isopropyl-, 2667^a.
 —, 2 propyl-, 2667^a.
 —, 2,2,6-trimethyl-, 2464^a.
 Cyclopentanone, 2,2,5,5 - tetramethyl-, 1635^a.
 Δ^2 - 2 - Hexenone, 3 ethyl - 4 - methyl-, 3187^a.
 2 Indanol, hexahydro-, 1112^a.
C₉H₁₆O₂ Cyclohexanol, methyl-, acetate, 374^a, 38^a.
 Ethylene oxide, α,α' -pentamethylenebis-, 59^a.
 α -Hexenic acid, β -propyl-, 3187⁷.
 Isocaproic acid, α - (β - hydroxypropyl)-, γ -lactone, 1097¹.
C₉H₁₆O₄ Caprylic acid, η -formyl-, 2119^a.
 Cyclopentaneacetic acid, α -ethyl 1 hydroxy-, 3187^a.
 Enanthic acid, γ keto α,ϵ dimethyl-, 907^a.
 2 Furanpropanol, tetrahydro-, acetate, 3053^a.
C₉H₁₆O₄ Azelaic acid, 390^a, 1631^a, 1964^a.
 Pimelic acid, dimethyl ester, 1216^a.
C₉H₁₆O₄ Glucosan, 2,3,4-trimethyl-, 225^a.
 Succinic acid, α -(α -hydroxyethyl)- β -methyl, mono Et ester, 386^a.
C₉H₁₆O₆ Glucose, acetone-, 2598^a.
C₉H₁₆O₆ Glucose, 1,2-glycerylene-, 2666¹.
C₉H₁₇BrO Cyclohexane, 1 bromo-2 propoxy-, 571^a.
 Heptenol, 3-bromo 2,6-dimethyl-, 733^a.
C₉H₁₇BrNO 4 - Acetyl - 2 - (bromomethyl)-1,1 - dimethylpyrrolidinium bromide, 1812⁷.
C₉H₁₇ClO Eranthoyl chloride, α,α -dimethyl-, 1796^a.
C₉H₁₇N Cyclohexylamine, N-propylidene-, 2876^a.
 Isoquinoline, decahydro-, and salts, 587¹.
 Quinoline, decahydro-, 2696⁷; and -HCl, 2903^a.
C₉H₁₇N₂O Cyclohexanecarboxamide, N-ethyl-, 2875^a.
 Hexenamide, β propyl-, 3187^a, 3.
 Δ^2 - 2 - Hexenone, 4 - (dimethylamino-methyl)-, 1121^a.
 2-Pyrrolidone, 3,3-diethyl-5-methyl-, 2472^a.
C₉H₁₇NO₂ Acrylic acid, β -diethylamino-, Et ester, 55^a.
 Alanine, N-cyclohexyl-, 2870^a.

- C₅H₁₁NO₂** Alanine, *N*-cyclohexyl- α -hydroxy-, 2876⁶.
- C₅H₁₁NO₄** Aspartic acid, monoisoamyl ester, 1798⁴.
- C₆H₁₁N₂O** Cyclohexanone, 3,5-dimethyl-, semicarbazone, 230⁸.
- C₆H₁₁** 3-Heptene, 2-ethyl-, 2271¹.
- C₆H₁₁BrClO₂** Formaldehyde, amyl β bromo- β' -chloroisopropyl acetal, 223⁹.
- C₆H₁₁Br₂O** 2-Heptanol, 3,4-dibromo 2,6-dimethyl-, 733⁷.
- C₆H₁₁Cl₂O₂** Formaldehyde, amyl β , β' dichloroisopropyl acetal, 223⁹.
- C₆H₁₁N₂** Acetone, cyclohexylhydrazone, -HCl, 1802³.
- C₆H₁₁N₂O** Δ^2 -2-Hexenone, 4-(dimethylamino-methyl)-, oxime, -HCl, 1121⁴.
- C₆H₁₁N₂O₄** Malonamide, α , α -diethyl-*N*,*N'*-dimethoxy-, 2249².
- C₆H₁₁N₂O** 2-Butanone, carbohydrazone, 1248⁸.
- C₆H₁₁O** Cyclohexanol, isopropyl-, 2252⁸, 2881⁹.
Heptanone, dimethyl-, 1796⁶.
 Δ^2 -2-Heptenol, 2,6-dimethyl-, 732⁹.
Hexanol, cyclopropyl-, 2666⁹.
2-Hexanone, 3,3,5 trimethyl-, 1796⁷.
- C₆H₁₁O₂** Caproic acid, β -propyl-, 3187⁷.
Enanthic acid, α , α dimethyl-, 1796⁶.
Enanthic acid, Et ester, 1453⁴.
Pelargonaldehyde, θ hydroxy-, 2119⁹.
Pelargonic acid, 1407⁹, 3004⁹.
2-Pentanone, 1 methyl 4-propoxy-, 892⁷.
- C₆H₁₁O₂** Butyl carbonate, 1729⁴.
Enanthic acid, α -hydroxy β , β -dimethyl, 1796⁶.
Isobutyl carbonate, 1729⁴.
Isovaleric acid, β butoxy-, 892⁷.
Pelargonic acid, θ hydroxy-, 2119⁹.
1,2,3-Propanetriol, 1-cyclohexyl-, 402⁹.
- C₆H₁₁O₄** Malonaldehyde acid, Et ester, di Et acetal, 55⁴.
- C₆H₁₁O₆** *d*-Glucose, trimethyl-, 1737, 226².
- C₆H₁₁O₈** Acetone, trithio-, trisulfone, 1094⁷.
- C₆H₁₁S** Sulfide, ethyl Δ^1 heptenyl-, 2118⁷.
- C₆H₁₁S₂** Acetone, trithio-, 1094⁷.
- C₆H₁₁Br** Nonane, bromo-, 563⁸, 895⁹.
- C₆H₁₁BrO₂** 2,4-Heptanediol, 3 bromo-2,6-dimethyl-, 733⁷.
- C₆H₁₁Cl** Nonane, 5 chloro-, 563⁸.
- C₆H₁₁ClO₂** 2,4-Heptanediol, 3 chloro-2,6-dimethyl-, 733⁷.
- C₆H₁₁N** Ethylenimine, 2,2-diethyl-3-propyl-, 2271².
- C₆H₁₁NO** Alanine, *N*, *N*-diethyl-, Et ester, 602³.
Cyclohexanol, 2-(dimethylamino-methyl)-, 1970³.
Cyclopentaneethanol, β dimethylamino-, and -HCl, 59⁴.
Enanthamide, α , α -dimethyl-, 1796⁶.
2-Hexanone, 3,3,5-trimethyl-, oxime, 1796⁷.
2-Propanol, 2-methyl-1-(1-piperidyl)-, and salts, 2271⁴.
- C₆H₁₁NO₂** Butyric acid, β isoamylamino-, 2876⁶.
Pelargonaldehyde, θ -hydroxy-, oxime, 2119⁹.
- C₆H₁₁N₂O₂** 2-Pentanone, 4 ethoxy 1-methyl-, semicarbazone, 892⁷.
- C₆H₁₁O₃P** Propionic acid, α (and β)-phosphono-, tri-Et ester, 1627⁷.
- C₆H₁₀** Nonane, 3452⁶.
- C₆H₁₀Hg** Butyl isoamyl mercury, 233⁹.
- C₆H₁₀Hg₂I₂N₂** Compd. from Hg deriv. of 3,6-dihydro-2,4- λ -triazinedimer-captan and MeI, 1101².
- C₆H₁₀N₂O** Acetamide, α -dimethylamino-*N*-isoamyl-, and -HCl, 1657⁷.
- 2-Butanone, 1 dimethylamino-3-dimethylaminomethyl-, and chloroplatinate, 1121⁶.
Isocaproamide, *N*-ethyl- α -methylamino-, and -HCl, 1657⁹.
Propionamide, *N* isoamyl α -methylamino-, 1657⁷.
- C₆H₁₀O** 2-Heptanol, 2,6-dimethyl-, 733⁷.
3-Hexanol, 3-isopropyl-, 892⁸.
2-Octanol, 2 methyl-, 3013⁷.
3-Pentanol, 3-ethyl-2,4-dimethyl-, 892⁴.
- C₆H₁₀O₂** 2,4-Heptanediol, 2,6-dimethyl-, 732⁹.
- C₆H₁₀O₂Pb** Triethyllead propionate, 1445⁴.
- C₆H₁₀As** Arsine, tripropyl-, 3612⁴.
- C₆H₁₂N** Diethylamine, *N*-(α ethylpropyl)-, 3346⁴.
Tripropylamine, 2659⁹.
- C₆H₁₁NO₂** 2-Butanol, 1-(β dimethylaminoethoxy) 2 methyl-, and -HCl, 3889⁷.
- C₆H₁₂CoN₂S** Bis-triaminopropanecobaltic thio-cyanate, 388⁶.
- C₆H₁₂N₂O** 2-Propanol, 1 dimethylamino 3-(β dimethylaminoethoxy)-, 3889⁹.
- C₁₀Fe₂N₂O₄** Iron ferri nitrito-pentacyanide, 176⁹.
- C₁₀H₁₁Cl₂O** β Cumidic acid, α , α , α' , α' -tetrachloro- α , α' -dihydroxy-, di γ lactone, 3897⁷.
- C₁₀H₁₁Cl₂O₂** Pyromellitic anhydride, *O*-octachloro substitution product, 3897⁷.
- C₁₀H₁₂N₂O** 3(1) Iadazolone, 1-ethyl-7-methyl-, 2899⁷.
- C₁₀H₁₂O₆** Pyromellitic anhydride, 1458⁶.
- C₁₀H₁₂Br₂N₂O** Naphthalene, 2-bromo-1,6,8-trinitro-, 53⁴, 404⁴.
- C₁₀H₁₂Cl₂N₂O** Naphthalene, 2-chloro-1,6,8-trinitro-, 53⁴, 404⁴.
- C₁₀H₁₂Cl₂O** β -Cumidic acid, α , α' dichloro- α , α' -dihydroxy-, di γ lactone, 3897⁷.
- C₁₀H₁₂Cl₂Sn** Compd. from naphthazarin and SnCl₄, 1477⁷.
- C₁₀H₁₂Cl₂N₂O₆** 1,3-Benzodioxan, 6,8-dinitro-2,3-bis(trichloromethyl)-, 3606⁹.
- C₁₀H₁₂Cl₂O** β -Cumidyl chloride, α , α , α' , α' -tetrachloro-, 3897⁷.
- C₁₀H₁₂Cl₂N₂O** 1,2,5-Triazole-3,4-dicarboxyl chloride, 1-phenyl-, 2690⁴.
- C₁₀H₁₂Cl₂NO** 1,3-Benzodioxan, 6-nitro-2,4-bis-(trichloromethyl)-, 233⁹.
- C₁₀H₁₂Cl₂O₂S** 1,3-Benzodioxan-6-sulfonyl chloride, 2,4-bis(trichloromethyl)-, 3607⁴.
- C₁₀H₁₂Cl₂NO₂S** 1,3-Benzodioxan-6-sulfonamide, *N*,*N*-dichloro-2,4-bis(trichloromethyl)-, 3607⁴.
- C₁₀H₁₂F₂O₂S** 2-Naphthol-3,6,8-trisulfonyl fluoride, 3607⁴.
- C₁₀H₁₂NO₆** 1,4-Naphthoquinone, 6-hydroxy-5-nitro-, 3052⁹.
- C₁₀H₁₂N₂O** 1,2,5-Triazole-3,4-dicarboxyl azide, 1-phenyl-, 2690⁴.
- C₁₀H₁₂As₂Br₂N₂** Pyridine, 3,3'-arsenobis[6-bromo-, 2902³.
- C₁₀H₁₂As₂Br₂N₂O** 2-Pyridol, 5,5'-arsenobis[3-bromo-, 2902³.
- C₁₀H₁₂As₂Cl₂N₂** Pyridine, 3,3'-arsenobis[6-chloro-, 2902³.
- C₁₀H₁₂As₂Cl₂N₂O** 2-Pyridol, 5,5'-arsenobis[3-chloro-, 2902³.
- C₁₀H₁₂As₂I₂N₂** Pyridine, 3,3'-arsenobis[6-iodo-, 2902³.
- C₁₀H₁₂As₂I₂N₂O** 2-Pyridol, 5,5'-arsenobis[3-iodo-, 2902³.

- C₁₀H₆ClFO₄S₂: Naphthalenedisulfonyl chloride fluoride, 3604².
- C₁₀H₆ClN₂: Pyrazo[4,5-*g*]quinoline, 9-chloro-, and -HCl, 2693².
- C₁₀H₆Cl₂N₂O₂S 3,4-Benzothiodiazole diol, 5,6-dichloro-, diacetate, 2690².
- C₁₀H₆Cl₂O₂S 3-Naphthol-3,6-disulfonyl chloride, 3605².
- C₁₀H₆Cl₂O₂ β-Cumidic acid, α,α',α',α'-tetra-chloro-, 3897².
- C₁₀H₆Cl₂O₂ 1,3-Benzodioxan, 2,4-bis(trichloromethyl)-, 233².
- C₁₀H₆Cl₂O₂S 1,3 - Benzodioxan - 6 - sulfonic acid, 2,4 - bis(trichloromethyl)-, and NH₄ salt, 3606².
- C₁₀H₆F₂O₄S₂: Naphthalenedisulfonyl fluoride, 3604².
- C₁₀H₆F₂O₄S₂: 2-Naphtholdisulfonyl fluoride, 3605².
- C₁₀H₆I₂NO₂: Cinchoninic acid, 1,2-dihydro-6-iodo-2-keto-, 586².
- C₁₀H₆I₂O₄: Furoxan, 3,4-di-2-furyl-, 1106². Naphthalene, dinitro-, 1983², 2268².
- C₁₀H₆I₂O₄S 4 - β - Naphthoxdiazolesulfonic acid, 2471¹.
- C₁₀H₆I₂O₆: 2-Naphthylamine, 1,6,8-trinitro-, 83², 404². 1,2,5 - Triazole - 3,4 - dicarboxylic acid, 1-(*p*-nitrophenyl)-, 2690².
- C₁₀H₆O₂: See *Naphthoquinone*.
- C₁₀H₆O₂: α-Juglone, 2013². Naphthoquinone, hydroxy-, 241², 1457².
- C₁₀H₆O₂: Naphthazarin, 1457², 3052².
- C₁₀H₆O₂: Camphoric acid, hydroxy-, 2331².
- C₁₀H₆AgN₂O 2(1)-Pyrimidone, 5-phenyl-, Ag deriv., 2259².
- C₁₀H₆BF₄N₂: 1-Naphthalenediazonium fluo borate, 2668².
- C₁₀H₆Br Naphthalene, bromo-, 82², 1049².
- C₁₀H₆Br₂NO₂: Vanillonitrile, 5,6-dibromo-, acetate, 2258².
- C₁₀H₆Br₂N₂: Pyridine, 2,2'-iminobis[bromo-, and di-HBr, 3619².
- C₁₀H₆Br₂O₂: Benzene, 1,2,3-tribromo-4-(β,γ-dibromopropyl) - 5,6 - methylenedioxy-, 3192².
- C₁₀H₆Cl Naphthalene, 2-chloro-, 82².
- C₁₀H₆ClN₂O 4-Isoimidazol-4-one, 5-chloro-2-*p*-tolyl-, 3613².
- C₁₀H₆Cl₂N₂: Pyrimidine, 4-anilino-2,6-dichloro-, 2271².
- C₁₀H₆Cl₂O₂ 1,3-Dioxol-4(5)-one, 5-phenyl-2-, (trichloromethyl)-, 1962².
- C₁₀H₆Cl₂NO₂: 1,3-Benzodioxan, 6-amino-2,4-bis(trichloromethyl)-, and -HCl, 233².
- C₁₀H₆Cl₂O₂S 1,3 - Benzodioxan - 6 - sulfonamide, 2,4-bis(trichloromethyl)-, 3607².
- C₁₀H₆F Naphthalene, 1-fluoro-, 2668².
- C₁₀H₆FO₄S 1-Naphthalenesulfonyl fluoride, 3604².
- C₁₀H₆NO₂: Cinchoninic acid, 2848². Cinnamic acid, α-cyano-, 3900². Naphthalene, 1-nitro-, 2681², 3047². Quinaldic acid, 2848².
- C₁₀H₆NO₂: Cinchoninic acid, 1,2-dihydro-2-keto-, 585². Kynurenic acid, 3660¹. 1,2,6 - Oxazin - 6 - one, 3-hydroxy-5-phenyl-, 223¹.
- C₁₀H₆NO₂S Cinchoninic acid, 1,2-dihydro-2-keto-3-mercapto-, 586¹.
- C₁₀H₆NO₂: Cinchoninic acid, 2,6-dihydroxy-, 3904².
- C₁₀H₆N₂: Pyrazo[5,4-*r*]quinoline, 2693².
- C₁₀H₆N₂O₂ 1,2,5 - Triazole - 3,4 - dicarboxylic acid, 1-phenyl-, 2268².
- C₁₀H₆N₂O₂: Compd. from alloxan and *o*-amino-phenylhydrazine, 2132².
- C₁₀H₆N₂O₂: Pyridine, 2,2'-iminobis[nitro-, 3619².
- C₁₀H₆: See *Naphthalene*.
- C₁₀H₆As₂N₂O₂: 2-Pyridol, 5,5'-arsenobis-, 2902².
- C₁₀H₆BrNO₂: Phthalimide, *N*-(β-bromoethyl)-, 3899².
- C₁₀H₆BrNO₂: Cinchoninic acid, 6(?) - bromo-1,2,3,4-tetrahydro-2-keto-, 586².
- C₁₀H₆Br₂N₂O₂: Benzoic acid, 3,5-dinitro-, β,γ-dibromopropyl ester, 1096².
- C₁₀H₆Br₂O₂: Pyrocatechol, 4,5-dibromo-, diacetate, 3606². Resorcinol, 4,6-dibromo-, diacetate, 3606².
- C₁₀H₆ClN Quinaldine, chloro-, and -HCl, 1651².
- C₁₀H₆ClNO₂: Homopiperonylonitrile, 6-(chloromethyl)-, 1270².
- C₁₀H₆ClN₂O₂: Pyrazole, chloromethyl-, picrate, 2898².
- C₁₀H₆Cl₂N₂O₂: Acetophenone, α,α-dichloro-2-ethoxy-3,5-dinitro-, 3606². 2-Propanol, 1,3-dichloro-, 3,5-dinitrobenzoate, 1096².
- C₁₀H₆Cl₂O₂ β-Cumidic acid, α,α'-dichloro-, 3897².
- C₁₀H₆FN₂O₂S₂: Naphthalenesulfonyl fluoride, sulfamyl-, 3604².
- C₁₀H₆I₂NO₂: Cinchoninic acid, 1,2,3,4-tetrahydro-6(?) - iodo-2-keto-, 586².
- C₁₀H₆I₂N₂: Pyrimidine, anilinoiodo-, 2271².
- C₁₀H₆I₂N₂: 3-Indolenitrile, 2-methyl-, 1115¹.
- C₁₀H₆I₂N₂O Imidazole, 7-benzoyl-, 1263². 2(1) - Isoquinolinenitrile, 1-hydroxy-, 2694². 2(1) - Pyrimidone, 5-phenyl-, and -HCl, 2259².
- C₁₀H₆N₂O₂: 4,5-Imidazoleione, 2-*p*-tolyl-, 3613². 3-Pyrrolicarboxylic acid, 2-(2-pyridyl)-, 406². 3 - Quinolincarboxylic acid, 2-amino-, and Mg salt, 900².
- C₁₀H₆N₂O₂S 2,4-Thiazoleione, 3-benzal-amino-, 2461².
- C₁₀H₆N₂O₂S 6,7 - Benzo - 8 - keto - 1,3,4-octathiodiazine, 2 - methylthio - 5-hydroxy-, 3199².
- C₁₀H₆N₂O₂: Δ²-3-Pyrazolincarboxylic acid, 5-keto-1-phenyl-, 611².
- C₁₀H₆N₂O₂: 3-Naphthyridinecarboxylic acid, 2,4-dihydroxy-, Me ester, 1649¹.
- C₁₀H₆N₂O₂: Benzoic acid, 3,5-dinitro-, allyl ester, 1096².
- C₁₀H₆N₂O₂: Glyoxylic acid, (2,4-dinitrophenyl)-, Et ester, 1257².
- C₁₀H₆N₂S₂: Disulfide, bis(thiono-2-pyrrolicarboxyl-), 1459².
- C₁₀H₆N₂: Pyridine, 2,2'-azobis-, and -HNO₂, 1814². Triazolo[3-*f*]quinoline, 3-methyl-, 2690¹.
- C₁₀H₆N₂O₂: See *Picrolonic acid*.
- C₁₀H₆N₂O₂: 2(3)-Benzimidazolone, 1-acetyl-3-methyl-5,6-dinitro-, 383².
- C₁₀H₆O (See also *Naphthol*.) Furan, 2-phenyl-, 3326². 1-Indanone, 2-methylene-, 582².
- C₁₀H₆O₂: Citronellal, hydroxy-, 2530². Coumarin, 4-methyl-, 3193². 1-Indanone, 2-(hydroxymethylene)-, 582². Naphthalenediol, 582², 1645². Phthalide, 2-ethylidene-, 2260².
- C₁₀H₆O₂: Acrylic acid, benzoyl-, 2859². Benzoic acid, 3-methyl-, 3192². Coumarin, 4-methoxy-, 3192².
- C₁₀H₆O₂S 2-Naphthalenesulfonic acid, 95².

- $C_{10}H_8O$, Cinnamic acid, 2,3-methylenedioxy-, 588⁴.
 3 - Isochromanone, 0,7 - methylenedioxy-, 1270⁴.
 • 1,2,5,8-Naphthalenetetrol, 3053¹.
 $C_{10}H_8O_3S$ Naphtholsulfonic acid, 875⁴, 3361⁴.
 $C_{10}H_8O_4$ 1-Isobenzofurancarboxylic acid, 1,2-dihydro - 3 - hydroxy - 2 - keto - 4 - methoxy-, 588³.
 1 - Isobenzofurancarboxylic acid, 1,2-dihydro - 3,4 - dihydroxy - 2 - keto-, Me ester, 588³.
 Quinone, 2,5-dihydroxy-, diacetate, 575⁴.
 $C_{10}H_8O_4S_2$ Naphthalenedisulfonic acid, 1456⁴, 1646⁴, 3616⁴.
 $C_{10}H_8O_6S_3$ 1-Naphthol-3,6,8-trisulfonic acid, 875⁴.
 $C_{10}H_8BrO_4$ Homopiperonylic acid, 6-(bromo-methyl)-, 1270⁷.
 Salicylic acid, bromopropionate, 1806⁴.
 $C_{10}H_8Br_2NO_4$ Benzoic acid, *p*-nitro-, β , γ -dibromopropyl ester, 1096².
 Carbanilic acid, 3,5-dibromo-2-hydroxy-, Me ester, acetate, 1120⁴.
 2-Propanol, 1,3-dibromo-, *p*-nitrobenzoate, 1090⁴.
 $C_{10}H_8Br_3O_4$ Cresol, 3,5,6-tribromo-, acetate, 2124¹.
 $C_{10}H_8Cl_2NO_4$ Pyruvohydroxamyl chloride, oxime, Bz deriv., 1099³.
 $C_{10}H_8ClO$ β -Butenyl chloride, γ -phenyl-, 228⁴.
 1(2) - Naphthalenone, 7-chloro-3,4-dihydro-, 1123⁴.
 $C_{10}H_8ClO_2$ 2(1) - Benzofuranone, 4-chloro-1,1-dimethyl-, 1117².
 $C_{10}H_8ClO_4$ Opianyl chloride, 1258³, 1642⁴.
 $C_{10}H_8ClO_4$ Benzoyl chloride, 3-hydroxy-5-methoxy-, Me carbonate, 3356⁴.
 $C_{10}H_8Cl_2NO$ Hydrocarbostyryl, 6,8-dichloro-4-methyl-, 1979⁴.
 $C_{10}H_8Cl_3N$ Acetimidyl chloride, α -trichloro-N-phenethyl-, 2876¹.
 $C_{10}H_8F_2NO_4S_2$ Naphtholdisulfonyl fluoride, NH₂ deriv., 3605⁴.
 $C_{10}H_8I_2NO$ 8-Hydroxy-5-iodo-1-methylquinolinium iodide, 1461⁴.
 $C_{10}H_8KO_2$ 1,3-Butanedione, 1-phenyl-, K deriv., 3357⁴.
 $C_{10}H_8KO_2$ Feraldehyde, K deriv., 2475⁷.
 $C_{10}H_8LiO_2$ 1,3-Butanedione, 1-phenyl-, Li deriv., 3357⁴.
 $C_{10}H_8N$ (See also *Naphthylamine*.)
 Pyrrole, phenyl-, 3047⁷, 3362⁴.
 Quinaldine, 586⁴.
 Quinoline, 3 methyl-, and salts, 585⁴.
 $C_{10}H_8NO$ 1-Indolealdehyde, 2 methyl-, 80⁴, 1984⁴.
 Isoxazole, methylphenyl-, 398⁴.
 1-Naphthol, amino-, 234⁴, 582².
 Quinoline, 6-methoxy-, 1121⁴.
 $C_{10}H_8NO_2$ Indoleacetic acid, 1308⁴.
 Indolecarboxylic acid, methyl-, 912³, 913¹.
 1-Naphthol, dihydro-4-nitroso-, 1646⁴.
 $C_{10}H_8NO_3S$ Benzoic acid, *o*(*m* and *p*) isothiocyano-, Et ester, 1637⁷.
 $C_{10}H_8NO_4$ 4-Benzisoxazolol, 2-methyl-, acetate, 3363⁴.
 Benzofuranone, acetamido-, 1678².
 1,2,3-Butanetrione, 1-phenyl-, 2-oxime, 565².
 Cinchoninic acid, 1,2,3,4-tetrahydro-2-keto-, 585⁴.
 Indoxylic acid, Me ester, 3602⁴.
 1(2) - Naphthalenone, 3,4 - dihydro-7-nitro-, 1123⁴.
 2,5 - Oxazolidione, 4-benzyl-3,4-dihydro-, 377⁴.
 $C_{10}H_8NO_3S$ Naphthalenesulfonic acid, amino-, 1640⁴, P 2479⁴, 3902⁴.
 Naphthionic acid, 875⁴, 1646⁷, P 2479⁴, 3361⁴, 3902⁴.
 $C_{10}H_8NO_4$ 1,3-Butanedione, 1-(nitrophenyl)-, 3611².
 $C_{10}H_8NO_4$ Acetophenone, α -hydroxy-*m*(and *p*)-nitro-, acetates, 2125⁴.
 Pyruvic acid, (6-nitro-*m*-tolyl)-, 3612⁴.
 $C_{10}H_8NO_6S$ Meconin, 3-nitro-, 3357⁷.
 Oxime from dilactone IV, 896⁴.
 Quinone, 2,5-dihydroxy-, oxime, diacetate, 575⁴.
 $C_{10}H_8NO_7S_2$ 1-Naphthol-5,7-disulfonic acid, 8-amino-, 875⁴.
 $C_{10}H_8NS_2$ 3-Indolecarboxylic acid, 2-methyldithio-, salts, 1460².
 $C_{10}H_8N_2NaOS$ 1,4,3 - Isothiodiazin-5-ol, 2-(benzylmercapto)-, Na deriv., 383⁴.
 $C_{10}H_8N_2$ Pyrimidine, 4-anilino-, 2271⁴.
 $C_{10}H_8N_2O_2$ 1,2 - Cyclopropanedicarboximide, 1,2-dicyano-3-ethyl-3-methyl-, 2877⁴.
 4,5-Pyrazolodione, 3-*p*-tolyl-, 4-oxime, 1100².
 1,2,5-Triazole-1-*p*-benzoic acid, Me ester, 2690⁴.
 $C_{10}H_8NaO_3S_2$ 1,4,3 - Isothiodiazin-5-ol, 2-[*o*(and *p*) - nitrobenzylmercapto]-, 383⁴.
 $C_{10}H_8N_2O_4$ 2(3) - Benzimidazolone, 1(and 3)-acetyl-3(and 1)-methyl-5-nitro-, 383¹.
 1-Isoindazolecarboxylic acid, 6-nitro-, Et ester, 1120¹.
 3(4)-Quinazolinecarbamic acid, 1,2-dihydro-2,4-diketo-, Me ester, 2697⁴.
 $C_{10}H_8N_2O_4$ 1,2,5-Triazole-3,4-dicarboxamide, 1-phenyl-, 2269¹, 2690⁴.
 $C_{10}H_8N_2O_4$ Isodialuric acid, *p*-nitrophenylhydrazone, 1447⁴.
 $C_{10}H_8NaO_4$ 1,3-Butanedione, 1-phenyl-, Na deriv., 3357⁴.
 $C_{10}H_8NaO_4$ Feraldehyde, Na deriv., 2475⁷.
 $C_{10}H_8O_3S_2$ Naphthalenesulfonic acid, 4-amino-, 875⁴.
 $C_{10}H_8O_4P$ Phosphoric acid, 2-naphthyl ester, salts, 2461¹.
 $C_{10}H_8O_7S_2$ 8-Naphthol-2,4-disulfonic acid, 1-amino-, 875⁴.
 $C_{10}H_{10}AsNO_3$ 3-Quinaldinearsonic acid, 2695⁴.
 $C_{10}H_{10}AsN_4$ Pyridine, 3,3'-arsenobis[6-amino-, 2902².
 $C_{10}H_{10}AsO_4$ Acetic acid, (α -carboxy-*p*-anisyl)-arseno-, 1628¹.
 $C_{10}H_{10}BrCuFN_2$, 868³.
 $C_{10}H_{10}BrNO_4$ Benzoic acid, *p*-nitro-, γ -bromopropyl ester, 1977⁷.
 $C_{10}H_{10}BrN_3$ 1,2,4-Triazole, 1-(*p*-bromophenyl)-3,5-dimethyl-, 3200⁴, 3620⁴.
 $C_{10}H_{10}BrCoN_2$ Addn. compd. of CoBr₂ and pyridine, 1235².
 $C_{10}H_{10}Br_2FeN_2 + 2H_2O$, 2232².
 $C_{10}H_{10}Br_2N_2O_2S_2$ 5-Benzothiazolecarboxylic acid, 1 amino-, Et ester, dibromide, 2688².
 $C_{10}H_{10}Br_2O$ Butyrophenone, α , β -dibromo-, 3901⁴.
 $C_{10}H_{10}ClNO$ Hydrocarbostyryl, 6(and 8)-chloro-4-methyl-, 1979⁴.
 $C_{10}H_{10}Cl_2FeN_2$, 2232².
 $C_{10}H_{10}Cl_2O_4$ Butyric acid, α , α -dichloro- γ -phenyl-, 2875².

- C₁₀H₁₀Cl₃N** Acetimidyl chloride, α, α -dichloro-*N*-phenethyl-, 28761.
Butyrimidyl chloride, α, α -dichloro-*N*-phenyl-, 28759.
C₁₀H₁₀Cl₃NO Acetamide, α -trichloro-*N*-phenethyl-, 28762.
Butyranilide, β , 2,4 trichloro-, 19797.
C₁₀H₁₀Cl₂NPt, 28561.
C₁₀H₁₀Cl₂NPt, 28561.
C₁₀H₁₀CoI₂N Addn. compd. of CoI₂ and pyridine, 12351.
C₁₀H₁₀FNO₂S 1-Naphthalenesulfonyl fluoride, 1,2,3,4-tetrahydro-2-nitro-, 36049.
C₁₀H₁₀HgINO₂ Acetanilide, 2 (and 4)-(acetoxymercuri)-4 (and 2)-iodo-, 39623.
C₁₀H₁₀INO₄ Succinic acid, (2-amino-5-iodo phenyl)-, 5862.
C₁₀H₁₀NNa α Tolunitrile, α ethyl-, α Na deriv., 9063.
C₁₀H₁₀N₂ 2(1) - Isoquinolinenitrile, 3,4-dihydro-, 26947.
 α -Nicotyrine, 1069; and isomer, 33627.
Pyridine, 2-(5-methyl 2-pyrryl)-, 4069.
C₁₀H₁₀N₂O 3-Indolealdehyde, 2 methyl, oxime, 871.
4 Pyrazolol, 3-benzyl-, 39032.
C₁₀H₁₀N₂OS₂ 1,4,3-Isothiadin-5-ol, 2-(benzylmercapto)-, 3831.
C₁₀H₁₀N₂O₂ Acetanilide, *N*-(cyanomethyl) α -hydroxy-, 17944.
Benzisoxazole, 4 acetamido 2-methyl-, 922.
Carbanilic acid, α -cyano-, Et ester, 11191.
Hydantoin, 3 methyl-1-phenyl-, 17954.
Naphthyridine, 2,4 dimethoxy-, 32033.
1,2,4 Oxadiazole, 3 ethoxy 5 phenyl-, 19766.
2-Pyrroleacrylic acid, α cyano-, Et ester, 3817.
Urea, [β - (hydroxymethylene)phenethyl iden]-, 22597.
C₁₀H₁₀N₂O₂S Acetic acid, (2 benzimidazolylmercapto)-, Me ester, 213.
5 Benzothiazolecarboxylic acid, 1-amino-, Et ester, 26887.
C₁₀H₁₀N₂O₃ Cinnamohydroxamic acid, β -carbamyl-, 2271.
Benzamide, *N* acetyl *N*-methyl- α -nitro-, 711.
Carbanilic acid, *N* acetyl- α -formyl (?), oxime, 11196.
Naphthalene, 1,2,3,4 - tetrahydro 5,8- (and 6,7) dinitro-, 19839.
Pyrrolohydroxamic acid, α tione, Bz deriv., 10974.
C₁₀H₁₀N₂O₄S₂ 1,5 - Naphthalenedisulfonamide, 36043.
C₁₀H₁₀N₂O₇ Creosol, 3,6 dinitro-, acetate, 36077.
C₁₀H₁₀N₄ Pyridine, 2,2'-hydrazolus, 18144.
1,2,3-Triazole, 1 benzalamino 4-methyl-, 927.
C₁₀H₁₀N₄O 1,2,3-Triazole, 1 benzamido-(and 5) methyl-, 927.
C₁₀H₁₀N₄O₂ Triazole, dimethylnitrophenyl-, 21339; and chlorophlatinate, 32909.
C₁₀H₁₀N₄O₄ 1,2,3 - Benzotriazine 3(4)-carbanne acid, 4-keto-, Et ester, 26975.
Isodiazolic acid, phenylhydrazone, 14173.
C₁₀H₁₀N₄O₅ 2(1) - Quinoxalone, 4 ethyl-3,4-dihydro-6-nitro 1 nitro-, 3833.
C₁₀H₁₀N₄O₅S 1,2,4 - Triazole - 1 benzene sulfonic acid, 3,5-dimethyl α' nitro-, 32909.
C₁₀H₁₀N₄O₉ Carbanilic acid, 4 methoxy 2,3,6-trinitro-, Et ester, 2339.
C₁₀H₁₀N₄O₉ Glutaric acid, α -(β , β' -dihydroxy isopropyl) - α hydroxy - β , β' - bis(hydroxymethyl) - γ keto (?), di γ lactone, di Na deriv., 8961.
C₁₀H₁₀O Δ^3 -2-Butenone, 4-phenyl-, 863.
Crotonophenone, 39014.
1-Indanone, 3-methyl-, 11238.
C₁₀H₁₀OS₂ 1,3-Benzodisulfide, 2-acetyl-2-methyl-, 729.
C₁₀H₁₀O₂ (See also *Safrrole*.)
Atropic acid, β -methyl-, 26767.
2(1) - Benzofuranone, 3,5-dimethyl-, 4071.
1,3-Butanedione, 1-phenyl-, 30476; *U compds.*, 33574.
Butenic acid, phenyl-, 2289; *K salt*, 2289.
Cinnamaldehyde, *m*-methoxy-, 28829.
Cinnamic acid, β -methyl-, 2289.
1 Indanone, 2-(hydroxymethyl)-, 5828.
Isocrotonic acid, γ -phenyl-, 22591.
Isosafrole, 26759.
1(2)-Naphthalenone, 3,4-dihydro-7-hydroxy-, 11232.
C₁₀H₁₀O₃ Cinnamic acid, β -methoxy-, 12579.
Ether, bis-(2-furylmethyl)-, 16495.
Ethylene oxide, α -methyl- β -(3,4-methylene-dioxyphenyl)-, 22715.
Glycidol, benzoate, 24613.
C₁₀H₁₀O₄ Benzoic acid, 2,3-methylenedioxy-, Et ester, 5883.
Cinnamic acid, 5-hydroxy 5-methoxy-, 33567.
Glyoxylic acid, (5 methyl- α -anisyl)-, 11171.
Mandelic acid, acetate, 29384.
Mecnonin, 33577.
Phthalic acid, di-Me ester, *TiCl₄ addn.* compd., 7397.
Piperonylic acid, Et ester, 14537.
C₁₀H₁₀O₄S₂ Acetic acid, *p*-phenylenedithiobis-, 10964.
C₁₀H₁₀O₄ Opianic acid, 12581, 33568.
C₁₀H₁₀O₄ Acetic acid, phenylenedioxybis-, 10967, 16121.
Benzoic acid, 3-hydroxy-5-methoxy-, Me carbonate, 33569.
C₁₀H₁₁As₂NO₃ Acetic acid, *p* (acetamidophenylarseno)-, -HCl, 16281.
C₁₀H₁₁As₂NO₃ Glycine, *N*-[*p* (carboxymethyl)-arsenophenyl]-, -HCl, 16281.
C₁₀H₁₁As₂NO₄ Acetic acid, 4-glycinephenyltetraarseno-, 16281.
C₁₀H₁₁Br 2-Butene, 4-(*p*-bromophenyl)-, 24663.
C₁₀H₁₁BrN₂O Acetamide, *N*,*N'*-(2-bromo-*p*-phenylene)bis-, 26719.
C₁₀H₁₁BrN₂S Benzothiazole, 5-bromo-1-propyl-amino-, 5845.
Urea, α -(β -bromoallyl)- β -phenylthio-, 537.
C₁₀H₁₁BrN₂O Allylamine, β bromo-*N*-methyl-, picrate, 539.
C₁₀H₁₁BrO Ethylene oxide, (*p*-bromophenethyl)-, 24663.
C₁₀H₁₁BrO₂ Benzoic acid, 5-bromo-2,4-dimethoxy-, Me ester, 2362.
C₁₀H₁₁Br₂ Butane, 1,2-dibromo-4-(*p*-bromiophenyl)-, 24663.
C₁₀H₁₁BrN₂S Benzothiazole, 5-bromo-1-propyl amino-, dibromide, 5845.
C₁₀H₁₁ClN₂O₇ Allylamine, chloro-*N*-methyl-, picrate, 539.
C₁₀H₁₁ClO₂ Hydrocinnamyl chloride, *m*-methoxy-, 22681.
Isobutyric acid, *p*-chlorophenyl ester, 11172.
Isobutyrophenone, 5-chloro-2-hydroxy-, 11172.
 α -Toluic acid, *p*-chloro-, Et ester, 14539.
C₁₀H₁₁ClO₃ Creosol, 5-chloro-(?), acetate, 36076.
Isobutyrophenone, 5-chloro- α , 2-dihydroxy-, 11177.
C₁₀H₁₁ClO₇ Glutaric acid, α -chloro- α -(β , β' -

- dihydroisopropyl) - β,β - bis(hydroxymethyl)- γ -keto-(?), di- γ -lactone, 896⁴.
- C₁₀H₁₁Cl₂N** Isobutyrimidyl chloride, α -chloro-*N*-phenyl-, 2875⁶.
- C₁₀H₁₁Cl₂NO** Acetamide, α,α -dichloro-*N*-phenethyl-, 2876¹.
- Butyranilide, dichloro-, 1979⁷, 2875⁹.
- C₁₀H₁₁FO₂S** 1-Naphthalenesulfonyl fluoride, 1,2,3,4-tetrahydro, 3604⁹.
- C₁₀H₁₁FO₂S** Benzoic acid, *m* (fluorosulfonyl), *Pr* ester, 3604⁸.
- C₁₀H₁₁IN₂O₂** Acetamide, *N*, *N'*-(iodophenylene)-bis-, 2671⁴, 577.
- C₁₀H₁₁IO₂** Acetic acid, iodophenoxy, ethyl ester, 1678⁷.
- C₁₀H₁₁IO₂** α -Toluic acid, *Et* ester, *K* deriv. of enol form, 1804³.
- C₁₀H₁₁N** Butyronitrile, γ -phenyl-, 1454¹.
- Hydrocinnamitrile, *p*-methyl-, 1461¹.
- Indole, 1²,2-dimethyl-, 1797².
- C₁₀H₁₁NO** Cinnamaldehyde, *N*-methyloxime, and -*III*, 743⁴.
- Hydrocarbostyryl, methyl-, 1979⁷, 899.
- (1(2) - Naphthalenone, 7-amino-3,4-dihydro-, -*HCl*, 1123⁴.
- C₁₀H₁₁NO₂** Acetanilide, *p* acetyl-, 905⁹.
- Acetoacetanilide, 395¹.
- Anthranilic acid, *N*- β -hydroxyethyl-*N*-methyl, lactone, and salts, 2467⁹.
- Δ^2 2 Butenone, 4-(*p*-hydroxyphenyl), oxime, 1440⁶.
- Carbanic acid styryl-, methyl ester, 2875⁴.
- Crotonamide, α -hydroxy γ phenyl-, 3051⁷, 8.
- Δ^2 - Cyclohexene - Δ^1,α - acetic acid, α -cyano-3-methyl-, 1103⁸.
- Indole, 5,6 dimethoxy-, 1649⁸.
- 3-Indolincarboxylic acid, 7 methyl, 912⁶.
- Lactamide, *N*-benzal, 1984⁸.
- 1-Naphthol, 5,6,7,8 - tetrahydro-4-nitroso-, 1646⁷.
- C₁₀H₁₁NO₄** Acetic acid, picolinyl-, *Et* ester, 406⁷.
- Acetophenone, 2-hydroxy-, acetyloxime, 92².
- 1-Naphthol, tetrahydronitro-, 1646⁸, 1983⁷, 9.
- C₁₀H₁₁NO₄** Acetophenone, 2,4(and 2,5)-dihydroxy, acetyloxime, 3363⁸, 8.
- Carbanilic acid, *o*-hydroxy-, *Me* ester, acetate, 1120⁷.
- Dimethyl ester, *m*. 155⁹, of acid from yohimboic acid, 414⁹.
- Glycine, *N* - acetyl - *N* - (hydroxyphenyl)-, 1704⁴, 5.
- Homopiperonylamide, 6 (hydroxymethyl), 1270⁴.
- Hydracrylaldehyde, α - methyl β -(*o*-nitrophenyl)-, 585⁸.
- Hydrocinnamic acid, β amino-3,4 methylenedioxy-, and -*HCl*, 1257³, 4.
- α -Toluic acid, α -ethyl-*p*-nitro-, 2676².
- α -Toluic acid, *p*-nitro-, *Et* ester, 1453⁸.
- C₁₀H₁₁NO₆** Benzene, 4-(α -methoxy- β -nitroethyl)-1,2-methylenedioxy-, 1462².
- Ether, methyl α -nitromethylpiperonyl, 1655⁶.
- C₁₀H₁₁NO₆** Benzoic acid, 2,4-dimethoxy-3-nitro *Me* ester, 1971².
- Homoveratric acid, 6-nitro-, 1649⁹.
- Mandelic acid, 2-ethoxy-5-nitro-, and *A* *g* salt, 233⁷.
- C₁₀H₁₁N₂O** Cinnamaldehyde, semicarbazone, 68⁹.
- 1-*as*-Spiroheptanecarboxamide, 1,2-dicyano-, 287⁹.
- C₁₀H₁₁N₂O₈** 1,3,4 - Thiadiazol-2(3)-one, 5-xylylamino-, 2900⁷.
- 1,2,4-Triazol-5(4)-one, 3-mercapto-4-xylyl-, 2900⁶.
- , 1-methyl - 3 - (methylmercapto)-4-phenyl, 2900⁸.
- C₁₀H₁₁N₂O₂** 1,3,4 - Oxadiazole, 5-ethoxy-2,3-dihydro-2 imino-3-phenyl-, 913⁷.
- α - Tolualdehyde, α -(hydroxymethylene)-, semicarbazone, 2259⁴.
- C₁₀H₁₁N₂O₂** Acetophenone, 3,4-methylenedioxy-, semicarbazone, 3350⁸.
- Pyruvohydroxamamide, benzoyloxime, 1090⁴.
- C₁₀H₁₁N₂O₂S** 1,2,4 - Triazole - 1 - benzene-sulfonic acid, 3,5-dimethyl-, and salts, 3200⁶, 7.
- C₁₀H₁₁N₂O₄** *p*-Quinonimine, 2,6-diacetamido-3-hydroxy-, 575³.
- 2(1) - Quinoxalone, 4-ethyl-3,4-dihydro-6(and 7)-nitro-, 383³.
- C₁₀H₁₁N₂O₇** Carbanilic acid, 4-methoxydinitro-, *Et* ester, 233², 3.
- C₁₀H₁₁N₂S₂** Δ^2 - 1,3,4 - Thiadiazoline, 2 methylmercapto-5-*p*-tolylimino-, 3199⁹.
- C₁₀H₁₁N₂O₂** Triazoledicarboxylic acid, 1-phenyl-, dihydrazide, 2690⁴, 5.
- C₁₀H₁₁O₂** Acetic acid, *p*-iodophenoxy-, *Et* ester, 1678⁷.
- C₁₀H₁₂** (See also *Tetralin*.)
- Dicyclopentadiene, 1730⁸.
- Styrene, α -ethyl-, 229¹.
- C₁₀H₁₂AsClIN₂O₈** Arsanilic acid, *N*-[*N*-(chloroacetyl)glycyl]-, 70⁹.
- C₁₀H₁₂As₂N₂O₂** Acetic acid, [*p*-(carbamylmercapto)amino]phenyl]arseno-, 1628¹.
- C₁₀H₁₂As₂N₂O₂** Acetic acid, glycineamidephenyl tetraarseno-, 1628².
- C₁₀H₁₂Br₂N₂O₆** 1 - Imidazolecarboxamide, tetrahydro - 2,4 - diketone - 3 - methyl-, *Ba* deriv. of isomer, 3353³.
- C₁₀H₁₂BrNO** Hydrocinnamamide, α -bromo-*N*-methyl-, 1658¹.
- C₁₀H₁₂BrNO₂** Homopiperonylamine, 6-bromo-*N* methyl-, and salts, 1270⁶.
- C₁₀H₁₂Br₂N₂S** Benzothiazole, 1-propylamino-, dibromide, 584¹.
- C₁₀H₁₂Br₂N₂O₈** Benzothiazole, 1-dimethylamino-5-methoxy-, tetrabromide, 2688⁸.
- C₁₀H₁₂Br₂N₂S** Benzothiazole, 1-dimethylamino-3(and 5) - methyl-, tetrabromide, and -*HBr*, 2688⁸, 9.
- Benzothiazole, 1-propylamino-, tetra bromide, 584¹.
- C₁₀H₁₂Br₂N₂S** Benzothiazole, 1-dimethylamino-5-methyl-, hexabromide, 2688⁸.
- C₁₀H₁₂ClNO** Acetamide, α -chloro-*N*-phenethyl-, 1657⁷.
- 2,6-Acetoxylyl, 3(and 4)-chloro-, 2670⁴.
- Carbanilic chloride, *N*-ethyl-*o*-methyl-, 1108⁸, 2899⁸.
- , *N*-isopropyl-, 1108⁸.
- , *N*-propyl-, 1108⁸.
- Propionanilide, β -chloro-*N*-methyl-, 1979⁹.
- Propionotoluide, β -chloro-, 1979⁸.
- C₁₀H₁₂ClNO₂** *p*-Acetophenetide, α -chloro-, 2256⁹.
- Butyranilide, β -chloro-*o*-hydroxy-, 1979⁷.
- C₁₀H₁₂Cl₂O₂S** *p*-Toluenesulfonic acid, β,β' -dichloroisopropyl ester, 3888².
- C₁₀H₁₂FO₂S** 1-Naphthalenesulfonyl fluoride, 7-amino - 1,2,3,4 - tetrahydro-, and -*HCl*, 3604⁹.
- C₁₀H₁₂N₂** Indole, (aminoethyl)-, 1308⁴, 2961³.
- C₁₀H₁₂N₂O** Benzimidazole, 2-ethoxymethyl-, *P* 158¹.

- Biacetyl, phenylhydrazone, 386⁷.
 Crotonanilide, β -amino-, 734¹.
 Isobutyronitrile, α - (p - hydroxyanilino)-, 1449⁸.
 Isoquinoline, 1,2,3,4 - tetrahydro-7-methyl-2-nitroso-, 1461¹.
 2-Pyrrolidone, 1-amino-5-phenyl-, and -HCl, 2897².
 C₁₀H₁₂N₂O₅ Benzothiazole, 1-dimethylamino-5-methoxy-, 2688⁸.
 C₁₀H₁₂N₂O₂ Acetaldehyde, oxime, *o*(and *p*)-methylcarbanilate, 1628⁸.
 Butyric acid, α -keto-, phenylhydrazone, 2462².
 Glyoxime, phenyl-, di-Me deriv., and -HCl, 1098⁷.
 C₁₀H₁₂N₂O₃ Benzoic acid, *o*(*m* and *p*)-thiocarbamido-, Et ester, 1637².
 C₁₀H₁₂N₂O₂ Barbituric acid, diallyl-, 777⁷.
 Carbanilic acid, *o*-formyl-, Et ester, oxime, 1119¹.
 α -Toluamide, α -ethyl-*p*-nitro-, 2676².
 C₁₀H₁₂N₂O₄ Acetoanilide, methylnitro-, 1970⁸, 1971².
 Benzoic acid, p - (β - hydroxyethylnitroso-amino)-, Me ester, 2467⁹.
 C₁₀H₁₂N₂O₂ Carbanilic acid, 4-methoxy-2-nitro-, Et ester, 233¹.
 C₁₀H₁₂N₂O₃ Benzamide, 3,4,5-trimethoxy-2-nitro-, 911⁸.
 Phenethylamine, *m*-nitro-, oxalate, 1250⁸.
 C₁₀H₁₂N₂S Benzothiazole, 1-dimethylamino-3(and 5)-methyl-, 2688⁸.
 Benzothiazole, 1-propylamino-, 584¹.
 C₁₀H₁₂N₄ 1,2,4-Triazole, 1-(aminophenyl)-3,5-dimethyl-, 3620⁴; and chloroplatinate, 3200⁷.
 C₁₀H₁₂N₂O Carbanil azide, *N*-ethyl-*o*-methyl-, 2899⁸.
 C₁₀H₁₂N₂O₂ Compd. from xyloquinone and diazomethane, 1254¹.
 Glyoxal, phenyl-, *O*-methyloxime, semicarbazone, 1098⁸.
 α - Toluualdehyde, α -(hydroxaminomethylene)-, semicarbazone, 2259⁴.
 C₁₀H₁₂N₂O₂ Biacetyl, oxime, α -nitrophenylhydrazone, 2133⁴.
 C₁₀H₁₂N₂O₄ Benzaldehyde, 2-ethoxy-5-nitro-, semicarbazone, 233⁸, 1108⁸.
 C₁₀H₁₂N₂O₃ (See also *Inosin*.)
 Quinone, 3,5 - diacetamido - 2 - hydroxy-, dioxime, 575².
 C₁₀H₁₂N₂O₄ Aniline, *N,N* - diethyl-2,4,6-trinitro-, 740².
 C₁₀H₁₂N₂O₇ Carbanilic acid, β -amino-4-methoxy-, γ , γ -dinitro-, Et ester, 233⁴.
 C₁₀H₁₂N₂O₇ Guanidine, α -allyl-, picrate, 62⁷.
 C₁₀H₁₂O (See also *Anethole*.)
 Benzofuran, 1,2 - dihydro - 1,2 - dimethyl-, 396⁷.
 Butyrophenone, 908⁸.
 Cumaldehyde, 3047⁸.
 Ethylene oxide, phenethyl-, 3899⁷.
 2-Naphthol, 5,6,7,8-tetrahydro-, 1983⁴.
 Phenol, α -(Δ^2 -butenyl)-, 396⁸.
 —, α -(α -methylallyl)-, 396⁸.
 C₁₀H₁₂O₅ α -Toluic acid, thiono-, Et ester, 2458².
 C₁₀H₁₂O₂ (See also *Eugenol*.)
 Acetophenone, 2-methoxy-4-methyl-, 410⁸.
 2-Butanone, 4-(p -hydroxyphenyl)-, 1449⁸.
 Butyric acid, γ -phenyl-, 3020².
 Isobutyrophenone, α -hydroxy-, 3611⁷.
 Isoeugenol, 2757².
 Phthalide, 2-ethyl-4,5-dihydro-, 2261¹.
 Thymoquinone, 2013⁸.
 Toluic acid, Et ester, 55⁷, 77⁸, 1458⁸, 1581¹, 1804⁷, 2254².
 Veratrole, 4-vinyl-, 3050².
 C₁₀H₁₂O₂S Benzoic acid, p -methylmercapto-, Et ester, 1453⁷.
 p -Toluic acid, α -mercapto-, Et ester, 3890¹.
 C₁₀H₁₂O₂Se Acetic acid, 2,4(and 3,4)-xylyl-selenyl-, 1252².
 C₁₀H₁₂O₂ Acetic acid, phenoxy-, ethyl ester, 1878⁸.
 Anisic acid, Et ester, 77⁸.
 Benzoic acid, *m*-methoxy-, Et ester, 1453⁷.
 —, p -isopropoxy-, 81⁸.
 Mandelic acid, Et ester, P 3057⁸, 3060⁸.
 C₁₀H₁₂O₄ (See also *Cantharidin*.)
 Acetophenone, hydroxydimethoxy-, 2530².
 Asaronaldehyde, 1974⁴.
 2-Furanpropionic acid, α -keto-3-methyl-, Et ester, 2896⁷.
 C₁₀H₁₂O₄ 3,4-Furandicarboxylic acid, 2,5-dimethyl-, mono-Et ester, and -HI, 3900¹.
 Iridic acid, 784¹.
 Ketodicarboxylic acid, *m*. 182-3°, from 4,4,5-trimethyl - Δ^3 - 1,3 - cyclopentenedicarboxylic acid, 1259⁴.
 C₁₀H₁₂O₃S Phenolsulfonic acid, methoxypropenyl-, *K salt*, 1453⁴.
 C₁₀H₁₂O₄ Spiro[furan-2(3), 1'-cyclopentane]-3,4-dicarboxylic acid, 4,5-dihydro-5-keto-, 2877⁸.
 C₁₀H₁₂O₅ Glutaric acid, α -(β , β' -dihydroxyisopropyl) - α - hydroxy - β , β - bis-(hydroxymethyl)- γ -keto-(?), di- γ -lactone, 896⁴.
 C₁₀H₁₂S₂ Toluic acid, dithio-, Et ester, 3609².
 C₁₀H₁₂As₂HgN₂O₇ Compd. from 3,5-diacetamido-4 - hydroxybenzenearsonic acid and Iig(OAc)₂, 70⁸.
 C₁₀H₁₂As₂N₂O₄ Benzenearsonic acid, 3,5-diacetamido-4-hydroxy-, 70⁸.
 C₁₀H₁₂As₂N₂O₂ Acetic acid, (p - β -hydroxyethylaminophenyl)arseno-, -HCl, 1628¹.
 C₁₀H₁₂As₂N₂O₃ Acetic acid, 4-hydroxyethylaminophenyltetraarseno-, 1628¹.
 C₁₀H₁₂Br Benzene, (α -bromobutyl)-, 2673⁷.
 C₁₀H₁₂BrN₂S Urea, α -(p -bromophenyl)- β -propylthio-, 584¹.
 C₁₀H₁₂Br₂NO₂ 2 - Azabicyclo[3.3.1]non-1-ene-4-carboxylic acid, 3-keto-5-methyl-, dibromide, 1103².
 C₁₀H₁₂ClN₂O₇ Ethylamine, β -chloro-*N,N*-dimethyl-, picrate, 2680⁸.
 C₁₀H₁₂ClO Ether, benzyl γ -chloropropyl, 1639².
 C₁₀H₁₂HgI₂O₃ (*o* - Carbomethoxyphenyl)dimethylsulfonium iodide, HgI₂ deriv., 1257⁷.
 C₁₀H₁₂I₂O₃ (*o* - Carbomethoxyphenyl)dimethylsulfonium pentaoidide, 1257⁷.
 C₁₀H₁₂N Homotetrahydroisoquinoline, 2696⁴.
 Isoquinoline, tetrahydromethyl-, 2694⁴; and -HCl, 1461¹.
 2-Naphthylamine, tetrahydro-, 1123⁸, 1479⁴, 1678⁸, 1851⁴, 2323⁸, 2329⁷.
 Quinaldine, 5,6,7,8-tetrahydro-, 2696⁴.
 Quinoline, 5,6,7,8-tetrahydro-8-methyl-, 2696⁴.
 C₁₀H₁₂NO (See also *Thalline*.)
 Acetamide, *N*-benzyl-*N*-methyl-, 78⁷.
 —, *N*-phenethyl-, 89⁸.
 Acetophenone, p -dimethylamino-, 909⁴.
 Acetylaldehyde, and salts, 2670⁸.

- Ketone, ethyl 6-ethyl-3-pyridyl, 386^a.
 2 - Naphthol, 3 - amino-5,6,7,8-tetrahydro-, 1963^l.
 Quinoline, 1,2,3,4-tetrahydro-8-methoxy-, and -HCl, 1121^a.
 α -Tolamide, α -ethyl-, 1640^l.
 $C_{10}H_{13}NO_5$ o-Acetotoluide, 4-methylmercapto-, 234^l.
 $C_{10}H_{13}NO_2$ (See also *Phenacetin*; *Propaesin*.)
 Anisamide, *N,N*-dimethyl-, 2669².
 Anthranilic acid, *N,N*-dimethyl-, Me ester, betaine, 2848².
 2-Butanone, 4 - (*p*-hydroxyphenyl)-, oxime, 1449^a.
 Carbamic acid, benzylmethyl-, Me ester, 1978¹.
 Carbamic acid, phenethyl-, methyl ester, 2875⁴.
 Isobutyrophenone, α -hydroxy-, oxime, 3611⁷.
 Phenol, *p*-ethylamino-, acetate, 2886².
 α -Toluic acid, *p*-amino-, Et ester, 1453².
 α -Toluic acid, *p*-amino- α -ethyl-, 2676².
 $C_{10}H_{13}NO_3S$ Cysteine, benzyl-, 3185².
 α -Toluenesulfonamide, *N*-allyl-, 90⁴.
 $C_{10}H_{13}NO_2$ Acetanilide, 3,4-dimethoxy-, 1635⁷.
 Anthranilic acid, *N*- β -hydroxyethyl-, Me ester, and salts, 2467⁸.
 2 - Azabicyclo[3.3.1]non-1-ene-4-carboxylic acid, 3-keto-5 methyl-, 1103².
 Benzoic acid, *p*-(β -hydroxyethylamino)-, Me ester, 2467⁸.
 Carbanilic acid, *p*-methoxy-, Et ester, 233¹.
 Cyclohexanecarboxylic acid, α -cyano-3-keto-1-methyl-, 1103².
 Glycine, *N*-(*p*-hydroxyphenyl)-, Et ester, 1794⁴.
 Homopiperonylamine, β -methoxy-, and -HCl, 1462², 1655².
 3 - Pyrrolicarboxylic acid, 5-acetyl-2-methyl-, Et ester, 381².
 Pyrrolicarboxylic acid, dimethylpropionyl-, 382¹.
 Veratraldehyde, *N*-methyloxime, 74².
 $C_{10}H_{13}NO_3S$ 2-Benzisulfonazotolol, 1,2-dihydro-2-propyl-, 3202².
 $C_{10}H_{13}NO_3S$ β -Alanine, *N*-methyl-*N*-phenylsulfonyl-, 258^{2,4}.
 Benzoic acid, *m*-(methylsulfamyl)-, Et ester, 3604².
 $C_{10}H_{13}NO_3$ Anthranilic acid, 3,4,5-trimethoxy-, 912².
 Oxime, decomps. 214², of ketodicarboxylic acid from 4,4,5-trimethyl - Δ^2 - cyclopentenedicarboxylic acid, 1259⁴.
 $C_{10}H_{13}NO_3S$ Piperonal, *N*-methyloxime, methosulfate, 74².
 $C_8H_9N_3S$ Butyramide, γ -phenylthio-, 1454¹.
 $C_{10}H_{13}NO$ Benzimidazole, 4-amino-5-ethoxy-2-methyl-, 2260².
 $C_{10}H_{13}N_2O_2$ Acetaldehyde, β -ethyl- β -(*p*-nitrophenyl)hydrazone, 1251⁴.
 $C_{10}H_{13}N_2O_2$ Acetic acid, β -ethyl- β -(*p*-nitrophenyl)hydrazone, 1251⁴.
 Benzamide, *N* - (γ - aminopropyl)-*m*-nitro-, 565⁷.
 Carbamic acid, β -anthranoyl-, Et ester, and -HCl, 2697².
 Compd., m. 240.5², from di-Me ester of o - (carboxyamino-carbamyl)carbanilic acid, 2697².
 $C_{10}H_{13}N_2O_4$ *p*-Acetophenetide, 2-amino-3-nitro-, 2260⁴.
 Aniline, *N*-butyl-2,4-dinitro-, 404².
 Veratraldehyde, 5-hydroxy-, semicarbazone, 78².
 $C_{10}H_{13}N_2S$ Acetone, δ -phenylthiosemicarbazone, 245⁷.
 $C_{10}H_{13}N_2S_2$ Carbazic acid, dithio- β -(thio-*p*-tolyl-carbamyl)-, Me ester, 3199².
 $C_{10}H_{13}N_4O_3P$ Inosinic acid, 100², 2706².
 $C_{10}H_{13}N_5O_2$ Adenosine, 2706².
 $C_{10}H_{13}N_2O_2$ Acetamide, α -amino-*N*-ethyl-, picrate, 1657².
 $C_{10}H_{14}$ (See also *Cymene*.)
 Benzene, diethyl-, 3047².
 —, *tert*-butyl-, 65², 3047⁴.
 $C_{10}H_{13}AsN_2O_2$ Arsanilic acid, *N*-(*N*-glycylglycyl)-, 71¹.
 $C_{10}H_{13}BrNO_2$ 2-Pyrrolicarboxylic acid, 5-(bromomethyl)-3,4-dimethyl-, Et ester, 85².
 $C_{10}H_{13}Br_2N_2$ 2,6 - *p* - Cymenediamine, 3,5-dibromo-, *di*-HBr, 903².
 $C_{10}H_{14}ClNO$ Allylhydroxymethylphenylammonium chloride, 65².
 $C_{10}H_{14}Cl_2O_2Zr$ Compd. from $ZrCl_4$ and acetylacetone, 1069⁴.
 $C_{10}H_{14}CrN_2S_4$, 1587².
 $C_{10}H_{13}CuO_4$ Δ^2 -2-Pentenone, 4-hydroxy-, Cu deriv., 1446².
 $C_{10}H_{14}Hg$ Butyl phenyl mercury, 233².
 2-Mesityl methyl mercury, 233².
 $C_{10}H_{14}INO$ (*p* - Formylphenyl)trimethylammonium iodide, 403², 895⁷.
 $C_{10}H_{14}N_2$ (See also *Nicotine*.)
 Quinoxaline, 1,2,3,4 - tetrahydro-2,3-dimethyl-, 1653^{2,7,8}.
 α -Toluidine, *N,N*-dimethyl-, 1108².
 β -Toluidine, *N,N*-dimethyl- α -methylimino-, 403⁴.
 $C_{10}H_{14}N_2O$ (See also *Coramine*.)
 Acetamide, α -amino-*N*-phenethyl-, -HCl, 1657⁷.
 Ketone, ethyl 6-ethyl-3-pyridyl, oxime, 387¹.
 Hydrocinnamide, α -amino-*N*-methyl-, -HBr, 1658¹.
 Nicotinamide, *N,N*-diethyl-, P 250².
 —, *N*-methyl-*N*-propyl-, P 250².
 $C_{10}H_{14}N_2O_3S$ Urea, β -*p*-anisyl- α , α -dimethylthio-, 2688².
 $C_{10}H_{14}N_2O_2$ (See also *Phenocoll*.)
 Carvacrylamine, 6-nitro-, and salts, 903^{2,4}.
 2-Indazolecarboxylic acid, tetrahydro-, ethyl ester, 2900².
 1-Isindazolecarboxylic acid, tetrahydro-, ethyl ester, 2900².
 Pyrazolecarboxylic acid, allylmethyl-, ethyl ester, 2899².
 Pyrocoll, 1,2,3,3i,6,7,8,8i-octahydro-, 87².
 $C_{10}H_{14}N_2O_2S$ *p*-Toluenesulfonic acid, isopropylidenehydrazide, 68².
 $C_{10}H_{14}N_2O_2$ Barbituric acid, isoallylpropyl, *Na* salt, 1489².
 Butyric acid, α , β -dihydroxy-, phenylhydrazide, 3350².
 $C_{10}H_{14}N_2O_4$ o-Veratric acid, 6-(hydroxymethyl)-hydrazide, 3357⁷.
 $C_{10}H_{14}N_2S$ Urea, α , α -dimethylthio- β -tolyl-, 2688^{2,4}.
 $C_{10}H_{14}N_2S_2$ Carbonic acid, dithiol-, Pr ester, phenylhydrazide, 391².
 $C_{10}H_{14}N_4O_2$ Carbanilic acid, *N*-(β -aminocarbamido)-, Et ester, -HCl, 69².
 3 - Pyrrolicarboxylic acid, 5-formyl-2-methyl-, Et ester, semicarbazone, 381².

- C₁₀H₁₄N₄O₄S₂** 2,5-Piperazinedione, 3,3'-dithiodimethylenebis-, 1966⁴.
- C₁₀H₁₄N₄O₇** Diethylamine, picrate, 1397².
Isobutylamine, picrate, 1397².
Tetramethylammonium picrate, 1397².
- C₁₀H₁₄N₄O₇P** Adenylic acid, 3076¹.
- C₁₀H₁₄N₄O₈P** + 2H₂O Guanine, nucleotide, 1990⁸.
- C₁₀H₁₄O** (See also *Carvacrol*; *Carvone*; *Thymol*.)
Benzyl alcohol, α -isopropyl-, 72⁸.
—, α -propyl-, 72⁸, 3887⁸.
Ether, isobutyl phenyl, 3897⁸.
Phenethyl alcohol, β -ethyl-, 1640⁴.
- C₁₀H₁₄O₂** 2-Butanol, 4-(p -hydroxyphenyl), 1449⁶.
Camphorquinone, 1225¹, 1259¹, 3023².
 Δ^2 -Cyclopentenecarboxylic acid, α -allyl-, 901⁶.
Ketone, isobutyl 3-methyl 2-furyl, 2896⁸.
1,3(2,4) - Naphthalenedione, hexahydro-, 9017.
1-Propanol, 3-benzyloxy-, 1639².
Resorcinol, butyl-, P 3711².
Thymohydroquinone, 1453⁶.
 α -Tolualdehyde, di-Me acetal, 3608².
- C₁₀H₁₄O₃** Camphenonic acid, 1011.
Camphoric anhydride, 577⁶.
Spiro[cyclohexane - 1,3'(2') furan]-2',5'(4')-dione, 2-methyl-, 1113⁸.
- C₁₀H₁₄O₃S** 1-Butanesulfonic acid, 1 phenyl, *Na salt*, 2673⁷.
 α -Toluenesulfonic acid, α -isopropyl-, 527.
—, α propyl-, 527.
- C₁₀H₁₄O₄** Benzyl alcohol, 2,4,6-trimethoxy-, 1121¹.
 Δ^4 -Cyclohexenecarboxylic acid, 4-hydroxy-5-keto-2,2,3-trimethyl-, 1259².
 Δ^1 -Cyclohexenemalonamic acid, α -methyl-, 228¹.
 Δ^3 -1,3-Cyclopentenecarboxylic acid, 4,5,5-trimethyl-, 1259^{1,4}.
 Δ^2 -Cyclopentenemalonamic acid, α -ethyl-, 901².
 Δ^2 -1,2-Cyclopropenedicarboxylic acid, 3-methyl-, di-Et ester, 1249⁷.
1,6- Δ^2 -Hexadienediol, diacetate, 2117⁶.
Muconic acid, di-Et ester, 3840⁹.
Phthalic acid, diethyl ester, 72⁸.
Spiro[cyclohexane - 1,2' - paraconic acid], 2877⁸.
- C₁₀H₁₄O₆** Cyclohexanemalonamic acid, 2-carboxy-, 586⁹.
Tartaric acid, diacetone deriv., 1798⁷.
- C₁₀H₁₄O₈** 1,1,4,4-Butanetetra-carboxylic acid, 2,3-dimethyl-, 3603⁷.
- C₁₀H₁₄S** Benzyl mercaptan, α -isopropyl-, 527.
Benzyl mercaptan, α -propyl-, 527.
- C₁₀H₁₄AgOS** Camphor, β -mercapto-, Ag deriv., AgNO₃ compd., 908¹.
- C₁₀H₁₄AgNO₃S** + H₂O Camphor, β -mercapto-, Ag deriv., AgNO₃ compd., 908¹.
- C₁₀H₁₄BrCdOS** Compd. from β -mercaptocamphor and CdBr₂, 908².
- C₁₀H₁₄BrClN** (p -Chlorobenzyl)trimethylammonium bromide, 53⁹.
- C₁₀H₁₄BrCl₂N** Tris(β -chloroallyl)methylammonium bromide, 53⁹.
- C₁₀H₁₄BrN₂** 2,6- p -Cymenediamine, 3-bromo-, and mono-HCl, 903⁸.
- C₁₀H₁₄BrO** Homocamphenilone, bromo-, 2891⁴.
- C₁₀H₁₄BrO₆** Methanetricarboxylic acid, bromo-, tri-Et ester, 52².
- C₁₀H₁₄BrN** Tris(β -bromoallyl)methylammonium bromide, 53⁹.
- C₁₀H₁₅ClO** $\Delta^1(\alpha)$ -Cyclohexaneacetyl chloride, α -ethyl-, 3187².
Epicauphor, 5-chloro-, 1109³, 3051⁹.
- C₁₀H₁₅IN₂O₂** Trimethyl(p -nitrobenzyl)ammonium iodide, 3614⁷.
- C₁₀H₁₅N** Aniline, *N*-butyl-, 1250⁸.
Benzylamine, α -isopropyl-, and -HCl, 3346⁹.
—, α -propyl-, and -HCl, 3346⁹.
2,5-Lutidine, 4-propyl-, 1460⁸.
Phenethylamine, *N,N*-dimethyl-, 1250⁸.
—, β -ethyl-, and -HCl, 1640⁴.
Propylamine, γ -*p*-tolyl-, and -HCl, 1461¹.
Quinoline, hexahydro-7(and 8)-methyl-, 2696⁹.
- C₁₀H₁₅NO** (See also *Ephedrine*.)
Benzyl alcohol, α -(α -aminopropyl)-, 908⁴.
Benzylamine, *o*(*m* and *p*)-methoxy-*N,N*-dimethyl-, and -HCl, 3614⁷.
Carvoxime, 14⁶.
Hordenine, and -HBr, 2669^{1,4}.
Ketone, ethyl 2,4,5-trimethyl-3-pyrrol-, 382¹.
Phenol, p -(γ -aminobutyl)-, 1449⁶.
Pseudoephedrine, 2321¹, 2532⁹, and salts, 773⁴.
- C₁₀H₁₅NO₂** Δ^3 - 2- Butenone, 4,4'-iminobis[3-methyl-, 386⁹.
Camphorquinone, 3-oxime, 237⁶.
1,1-Cyclohexanediacetimide, 1968¹.
Guaiacol, 4-(β -methylaminoethyl)-, 96⁸.
Pyrocatechol, 4-(β -dimethylaminoethyl)-, 2699⁴.
2-Pyrrolecarboxylic acid, 3-ethyl 5-methyl-, Et ester, 103⁹.
—, 3,1,5-trimethyl-, Et ester, 85⁹.
- C₁₀H₁₅NO₃** Indoxylic acid, 3i,4,5,6,7,7-hexahydro-, Me ester, 215⁶.
Pseudoescopine, acetate, *chloroaurate*, 3365⁸.
- C₁₀H₁₅NO₄** Cyclohexanemalonamic acid, 3-keto-1-methyl-, 1103⁷.
4-Piperidinebutyric acid, 2,6-diketo-4-methyl-, 1103⁷.
- C₁₀H₁₅NO₅S** Anisaldehyde, *N*-methyloxime, methosulfate, 74⁴.
- C₁₀H₁₅N₂** Quinazoline, 2-amino-5,6,7,8-tetrahydro-4,8-dimethyl-, 3198⁷.
- C₁₀H₁₅OP** Phosphine oxide, dimethylphenethyl-, 66⁹.
Phosphine oxide, methylphenylpropyl-, 66².
- C₁₀H₁₆** (See also *Camphene*; *Limonene*; *Nopinene*; *Pinenene*.)
 Δ^3 Carene, 798⁸.
Endocamphene, 2891¹.
Terpinene, 1805⁷.
Thujene, 2469⁶.
- C₁₀H₁₆Br₂Hg₂O** Compd. from nopinene, 400⁹.
- C₁₀H₁₆Br₂O₄** Adipic acid, α,δ -dibromo-, di-Et ester, 60².
Adipic acid, α,δ -dibromo-, di-Et ester, 3890⁴.
- C₁₀H₁₆Br₄** Menthane, tetrabromo-(?), 237⁴.
- C₁₀H₁₆ClNO** Pinene, nitroschloride, 2889⁹.
- C₁₀H₁₆Cl₂N₂O₃** Glycine, *N*-[*N*-(*N*-chloroacetyl)alanyl]alanyl-, 97⁹.
- C₁₀H₁₆Cl₂Hg₂O** Compd. from nopinene, 400⁹.
- C₁₀H₁₆Cl₂N₂O₂** Piperazine, 1,4-bis(chloroacetyl)-2,5-dimethyl-, 384¹.
- C₁₀H₁₆Cl₂O₂** Sebacyl chloride, 3043⁸.
- C₁₀H₁₆Cl₂N** Cyclohexaneacetimidyl chloride, α,α -dichloro-*N*-ethyl-, 2876¹.
- C₁₀H₁₆Cl₂Cr₂O₄** Addn. compd. from CrO₂Cl and rubber, 1902².
- C₁₀H₁₆Hg₂I₂O** Compd. from nopinene, 400⁹.
- C₁₀H₁₆INO** (*o*-Hydroxybenzyl)trimethylammonium iodide, 3614⁷.

- $C_{10}H_{15}N_2$ 2,6-*p*-Cymenediamine, 903^s.
 $C_{10}H_{17}N_2O_2$ Barbituric acid, butylethyl-, P 301^s, P 1522^s.
 Pyrimidine, 2,4,6-triethoxy-, 2271^s.
 $C_{10}H_{15}N_2O_4$ Barbital, 1-ethoxy-, 2249^s.
 $C_{10}H_{18}O$ (See also *Camphor*; *Citral*; *Epicamphor*; *Fenchone*; *Hexelone*; *Isopulegone*; *Pulegone*.)
 2-Butanone, 1- Δ^1 -cyclohexenyl-, 3186^s.
 Carone, 3192^s.
 Cyclopentanone, 2-ethyl-2-isopropenyl-, 1103^s.
 Homocamphenilone, 2891^s.
 2(1)-Naphthalenone, octahydro-, 1112^s.
 Δ^7 -4-Octenone, 2-methyl-6-methylene-, 907^s.
 2-Pentanone, 3- Δ^1 -cyclopentenyl-, 3186^s, 3187^s.
 Pinocarveol, 2679^s.
 Sabinol, 237^s.
 Verbenol, 2888^s.
 $C_{10}H_{16}OS$ Camphor, β -mercapto-, *SnCl₂ compd.*, 908^s.
 $C_{10}H_{16}O_2$ $\Delta^1(\alpha)$ -Cyclohexanecarboxylic acid, α -ethyl-, 3187^s.
 Cyclohexanecarboxylic acid, 2-(α -hydroxyisopropyl)-, lactone, 590^s.
 Δ^1 -Cyclohexanecarboxylic acid, α -ethyl-, 3187^s.
 Δ^7 -Cyclopenteneacetic acid, α -isopropyl-, 901^s.
 —, α -propyl-, 901^s.
 Δ^1 -1-Hexadienol, 2,5-dimethyl-, acetate, 302^s.
 Δ^2 -3-*p*-Menthonol, 4,8-epoxy-, and isomer, 2889^s.
 $C_{10}H_{16}O_4$ Adipic anhydride, tetramethyl-, 1968^s.
 Cyclohexanecarboxylic acid, 4-keto-2,2,3,4-trimethyl-, 1259^s.
 Cyclopentanepropionic acid, 2-keto- β,β -dimethyl-, 1103^s.
 Oxidation compd. from balata, 1903^s.
 $C_{10}H_{16}O_4$ Camphoric acid, 577^s, 2331^s.
 1,1-Cyclohexanedicarboxylic acid, di-Et ester, 1249^s.
 1-Cyclohexanecarboxylic acid, 1-carboxy-2-methyl-, 1113^s.
 1,2-Cyclohexanedicarboxylic acid, 1112^s.
 1,1-Cyclohexanedicarboxylic acid, di-Me ester, 220^s.
 1,3-Cyclopentanedicarboxylic acid, 4,4,5-trimethyl-, 1259^s.
 1,4-Naphthoquinone, 2-(2,4-dihydroxyphenyl)-, 2887^s.
 $C_{10}H_{16}O_5$ Adipic anhydride, α,δ -diethoxy-, 3890^s.
 1,3-Cyclopentanedicarboxylic acid, 1-hydroxy-4,4,5-trimethyl-, 1260^s.
 2-Pyrancarboxylic acid, 5-ethoxytetrahydro-6-keto-, Et ester, 3890^s.
 $C_{10}H_{16}O_6$ Lactaldehyde, acetate, dimer, 1797^s.
 $C_{10}H_{17}Br$ Isobornyl bromide, 2890^s.
 Norcamphane, 2-bromo-2,3,3-trimethyl-, 2890^s.
 $C_{10}H_{17}Cl$ Camphane, 2-chloro-, 801, 1109^s, 2265^s.
 $C_{10}H_{17}ClNO$ Cyclohexanecetamide, α,α -dichloro-*N*-ethyl-, 2876^s.
 $C_{10}H_{17}Cl_3O_2$ 1-Pentanol, 1-(trichloromethyl)-, butyrate, 1625^s.
 $C_{10}H_{17}N$ Camphane, 2-imino-, 1808^s.
 Fenchane, 2-imino-, 1808^s.
 $C_{10}H_{17}NO$ Camphor, oxime, 75^s.
 $\Delta^1(\alpha)$ -Cyclohexanecetamide, α -ethyl-, 3187^s.
 Δ^1 -Cyclohexanecetamide, α -ethyl-, 3187^s.
 Homocamphenilone, oxime, 2891^s.
 $C_{10}H_{17}NO_2$ 1-Piperidineacrylic acid, Et ester, 55^s.
 $C_{10}H_{17}NO_3S$ Butylsulfuric acid, $PhNH_2$ salt, 53^s.
 Isoamylsulfuric acid, pyridine salt, 53^s.
 Isobutylsulfuric acid, $PhNH_2$ salt, 53^s.
 $C_{10}H_{17}NS_2$ 1(2)-Quinolincarboxylic acid, octahydrodithio-, 2903^s.
 $C_{10}H_{17}N_2O$ 2-Indanone, hexahydro-, semicarbazono-, 1112^s.
 $C_{10}H_{17}N_2O_2$ Cyclobutanecarboxylic acid, 3-(formylmethyl)-2,2-dimethyl-, semicarbazono-, 2679^s.
 2,5-Piperazinedione, 1-leucyl-, 1966^s.
 $C_{10}H_{17}N_2O_4$ 1,3,5,2-Oxiazine-2-acetic acid, 2-ethyltetrahydro-4-keto-3,5-dimethyl-6-methylimino-, 2131^s.
 $C_{10}H_{18}$ (See also *Decalin*)
 Bicyclopentyl-, 900^s.
 Cyclohexane, 1,1,2-trimethyl-3-methylene-, 738^s.
 Endocamphene, dihydro-, 2891^s.
 Octadiene, dimethyl-, 50^s, 733^s.
 $C_{10}H_{15}BrNO_2$ Isobutyric acid, α -(α -bromoisocaproylamino)-, 1966^s.
 Leucine, *N*-(α -bromoisobutyl)-, 1966^s.
 $C_{10}H_{15}ClO_5Zr$ Compd from $ZrCl_4$ and lactic acid Et ester, 1069^s.
 $C_{10}H_{15}N_2O$ Menthone, pernitroso-, 2679^s.
 2,5-Piperazinedione, 3-hexyl-, 1965^s.
 —, 6-isobutyl-3,3-dimethyl-, 1966^s.
 $C_{10}H_{15}N_2O_5$ Hydrouacil, 5,5-diethoxy-6-hydroxy-1,3-dimethyl-(?), 1447^s.
 Isobarbituric acid, 5,6-diethoxy-5,6-dihydro-1,3-dimethyl-(?), 1447^s.
 $C_{10}H_{15}N_3O_5$ Glycine, *N*[*N*-(*N*-glycylalanyl)-alanyl]-, 97^s.
 $C_{10}H_{15}N_3O_5S_2$ Cystine, diglycyl-, 3071^s.
 $C_{10}H_{15}O$ (See also *Borneol*; *Cineol*; *Citronellal*; *Geraniol*; *Isobornol*; *Isocitronellal*; *Isualool*; *Menthone*; *Nerol*; *Terpinolol*.)
 5-Carol, 3192^s.
 Cyclohexanone, isopropylmethyl-, 2465^s.
 —, tetramethyl-, 2464^s.
 Cyclopentanol, 2-cyclopentyl-(?), 900^s.
 Endoborneol, 3612^s.
 Epiborneol, 1109^s.
 Homocamphenilol, 2891^s.
 Isofenchyl alcohol, 2679^s.
 2-Naphthol, decahydro-, 1112^s.
 Δ^7 -4-Octenol, 2-methyl-6-methylene-, 907^s.
 Δ^7 -1-Octenone, 2,6-dimethyl-, 907^s.
 $C_{10}H_{15}O_2$ η -Decenic acid, 3350^s.
 β -Pentenic acid, α -ethyl- β -methyl-, Et ester, 3187^s.
 $C_{10}H_{15}O_3$ Caproic acid, α -acetyl-, Et ester, 3889^s.
 Cyclohexanecarboxylic acid, α -ethyl-1-hydroxy-, and *Ag* salt, 3187^s.
 $C_{10}H_{15}O_4$ Adipic acid, di-Et ester, 375^s, 2462^s.
 Adipic acid, tetramethyl-, 58^s.
 Sebamic acid, 258^s, 1965^s.
 Suberic acid, dimethyl ester, 1210^s.
 $C_{10}H_{15}O_5S$ Propionic acid, β,β' -thiobis-, di-Et ester, 1262^s.
 $C_{10}H_{15}O_6$ Adipic acid, α,δ -diethoxy-, 3890^s.
 Galactonolactone, tetramethyl-, 2879^s.
 Gluconic acid, 2,3,5,6-tetramethyl-, lactone, 1101^s.
 Gluconolactone, tetramethyl-, 2879^s.
 Mannolactone, tetramethyl-, 2879^s.
 $C_{10}H_{15}O_7$ Erythrose, *d*-galacto-*d*-, 393^s.
 $C_{10}H_{15}BrO_2$ Capraldehyde, α -bromo-, 894^s.
 $C_{10}H_{15}BrO_2$ Acetic acid, bromo-, α -methylheptyl ester, 1095^s.
 Capric acid, α -bromo-, 894^s.

- C₁₀H₁₇Cl** Menthane, 3-chloro-, 1806².
C₁₀H₁₇OIO Acetic acid, chloro-, α -methylheptyl ester, 1095⁴.
C₁₀H₁₇OIO.S Cyclohexane, 1,1-bis(ethylsulfonyl)-2-chloro-, 2885¹.
C₁₀H₁₇OIS Cyclohexane, 1-bis(ethylmercapto)-2-chloro-, 2885¹.
C₁₀H₁₇IO Acetic acid, iodo-, α -methylheptyl ester, 1095⁴.
C₁₀H₁₇KO Glucoside, 2,3,6-trimethyl- β -methyl-, K salt, 225⁴.
C₁₀H₁₇N Bornylamine, 2264⁴.
 Capronitrile, α -butyl-, 563³.
 5-Carylamine, 3192¹.
 Epibornylamine, and salts, 3051³, 3052¹.
 Menthane, 3-imino-, and -HCl, 1808², 1809².
 Neobornylamine, 2264⁴.
 Quinoline, decahydromethyl-, 2696⁷.
C₁₀H₁₇NO Acetamide, *N*-(3,5-dimethylcyclohexyl)-, 230⁹.
 2-Butanone, 3-methyl-4-(1-piperidyl)-, and -HCl, 1121⁴.
 Cyclohexanacetamide, *N*-ethyl-, 2876¹.
 Menthone, oxime, 400⁴, 1806⁴; -HCl, 2889⁵.
C₁₀H₁₇NO₂ Butyric acid, β -(cyclohexylamino)-, and -HCl, 2876⁷.
 Carbamic acid, Δ^1 -octenyl-, methyl ester, 2874⁴.
C₁₀H₁₇NO₃ Butyric acid, α , α -diethyl- β -keto-, Et ester, oxime, 3347⁷.
 Sebacamic acid, 258³.
C₁₀H₁₇NO₄ Amide, m. 100-1⁰, from tetramethyl- γ -fructose, 3182⁹.
 Amide, m. 118-9⁰, from tetramethylglucose, 2665⁵.
C₁₀H₁₇N₂O Δ^4 -2-Hexenone, 3-ethyl-4-methyl-, semicarbazone, 3187³.
C₁₀H₁₇N₂O₂ Caprylic acid, η -formyl-, semicarbazone, 2119⁴.
 Enanthic acid, δ -acetyl-(?), semicarbazone, 1103³.
C₁₀H₁₇N₂O₃ Glycine, *N*-(*N*-leucylglycyl)-, 567².
C₁₀H₁₇N₂O₄ Leucine, glycyl-, Et ester, 3206².
C₁₀H₁₇N₂O₅ Cystine, di-Et ester, di-HCl, 3185².
C₁₀H₁₇N₂O Piperazine, 1,4-diglycyl-2,5-dimethyl-, and di-HCl, 3841⁴.
C₁₀H₁₇N₂S₂ 1,4-Piperazinedicarbonylloxamide, *N*, *N'*-diethyldithio-, 1799¹.
C₁₀H₁₇O (See also *Isomenthol*; *Menthol*.)
 Δ^4 -1-Decenol, 3350¹.
 Heptanol, cyclopropyl-, 2666⁴.
 8-*p*-Menthanol, 2890¹.
 Octanone, dimethyl-, 907³, 1796⁴.
 Δ^4 -3-Octenol, 3,7-dimethyl-, 732⁹.
C₁₀H₁₇O₂ (See also *Terpinol*.)
 Caprylic acid, Et ester, 1453⁷.
 m-Dioxane, 2,5-diethyl-2,5-dimethyl-(?), 3889⁹.
 2-Pentanone, 4-butoxy-4-methyl-, 892⁷.
 —, 4-isobutoxy-4-methyl-, 892⁷.
C₁₀H₁₇O₃ Valeric acid, α -ethyl- β -hydroxy- β -methyl-, Et ester, 3187³.
C₁₀H₁₇O₄ 1,3-Dioxolan-4-aldehyde, 2,2-dimethyl-, di-Et acetal, 1797².
C₁₀H₁₇O₄S Cyclohexane, 1,1-bis(ethylsulfonyl)-, 2884⁴.
C₁₀H₁₇O₅ Fructose, tetramethyl-, 2665⁵, 3182⁹.
 d-Glucose, tetramethyl-, 2252⁴, 3181⁴.
 Glucoside, trimethylmethyl-6³-, 226³, 3891⁵.
 Mannose, tetramethyl-, 2879⁴.
C₁₀H₁₇O₆ Cyclohexane, 1,1-bis(ethylmercapto)-, 2884⁴.
C₁₀H₁₇Br Decane, 1-bromo-, 2658⁴.
C₁₀H₁₇Cl Decane, 1-chloro-, 2658⁴.
- C₁₀H₁₇I** Decane, 1-iodo-, 2658⁴.
C₁₀H₁₇N Ethylenimine, 2,2-diethyl-3-isobutyl-, 2271².
 Menthylamine, 1806²; and salts, 79², 333².
C₁₀H₁₇N₂O 2-Butanol, 2-methyl-3-(1-piperidyl)-, and salts, 2271⁴.
 Cyclohexanol, *o*-diethylamino-, -HCl, 1977⁴.
C₁₀H₁₇NO₂ Butyric acid, β -amino- α , α -diethyl-, Et ester, and salts, 3347⁷.
 Butyric acid, α -diethylamino-, Et ester, 60⁴.
C₁₀H₁₇N₂O Heptanone, dimethyl-, semicarbazone, 1706⁴.
 Hexanone, trimethyl-, semicarbazone, 1796⁷.
C₁₀H₁₇N₂O₂ Pelargonaldehyde, θ -hydroxy-, semicarbazone, 2119⁴.
 2-Pentanone, 4-methyl-4-propoxy-, semicarbazone, 892⁷.
C₁₀H₁₇ See *Decane*.
C₁₀H₁₇Cl₂N₂O₄Pt, 2621³.
C₁₀H₁₇INO (α -Cyclopentyl- β -hydroxyethyl)-trimethylammonium iodide, 59⁴.
C₁₀H₁₇INO₂ (α -Carboxyethyl)diethylmethylammonium iodide, Et ester, 60⁴.
 Triethyl(β -hydroxyethyl)ammonium iodide, acetate, 2249¹.
C₁₀H₁₇N₂O Isocaproamide, *N*-ethyl- α -ethylamino-, and -HCl, 1657⁷.
 Propionamide, α -ethylamino-*N*-isoamyl-, 1657⁷.
C₁₀H₁₇O Amyl ether, 1697⁹.
 Decyl alcohol, 2658⁴, 3551⁷.
 4-Heptanol, 4-isopropyl-, 892⁷.
 3-Hexanol, 3-isopropyl-2-methyl-, 892⁷.
 Isoamyl ether, 3298².
C₁₀H₁₇O₂ 3,5-Octanediol, 3,7-dimethyl-, 732⁹.
C₁₀H₁₇O₂Pb Triethyllead butyrate, 1445⁵.
 Triethyllead isobutyrate, 1445⁵.
C₁₀H₁₇O₃S 2-Butanol, 1,1'-thiobis[2-methyl-, 2876⁴.
C₁₀H₁₇O₄P₂ Hexosephosphoric acid, di-, tetra-*m* ester, 2462⁹.
C₁₀H₁₇NO 1-Pentanol, 2-(α -aminoethyl)-2-propyl-, and salts, 3347⁷.
C₁₀H₁₇CuN₂O₄ Bis(triaminopropanemonothiocyanate)cupric thiocyanate, 388⁹.
C₁₀H₁₇N₄ piperazine, 1,4-bis(γ -aminopropyl)-, and tetra-HCl, 566³.
C₁₀H₁₇AuS₂O, 3495⁵.
C₁₀H₁₇I₂N₂ Ethylenebis[ethyldimethylammonium iodide], 2660⁴.
C₁₀H₁₇N₄ See *Spermine*.
C₁₀H₁₇CuN₂O₄ + 4H₂O Tetramethylammonium cupribiuret, 866⁴.
C₁₀H₁₇Cl₂N₂O₄Pt (β -Hydroxyethyl)methoxydimethylammonium chloroplatinate, 2248⁹.
C₁₀H₁₇CdCuN₂O₄ + 4H₂O Cadmium ethylenediamine cupribiuret, 866⁴.
C₁₀H₁₇OdN₂NiO₄ + 4H₂O Cadmium ethylene nickel biuret, 866⁴.
C₁₀H₁₇CoCuN₂O₄ + 4H₂O Cobalt ethylenediamine cupribiuret, 866⁴.
C₁₀H₁₇CuN₂NiO₄ + 4H₂O Nickel ethylenediamine cupribiuret, 866⁴.
C₁₀H₁₇CuN₂O₄Zn + 4H₂O Zinc ethylenediamine cupribiuret, 866⁴.
C₁₀H₁₇N₂NiO₄ + 4H₂O Nickel ethylenediamine nickel-biuret, 866⁴.
C₁₁H₁₇Cl₃N₃O 1,2,5-Triazole-3,4-dicarboxyl chloride, 1-[β -(chloroformyl)-phenyl]-, 2690⁴.
C₁₁H₁₇Br₃N₃O 1-(2,5,6-Tribromo-3,4-di-

- hydro - 3,4 - diketophenyl)pyridinium nitrate, 1640⁸.
- C₁₁H₈Cl₂NO₂** 1,3 - Benzodioxan - 6 - nitrile, 2,4 - bis(trichloromethyl)-, 1980⁸.
- C₁₁H₈Cl₂O** 1,3 - Benzodioxan - 6 - carboxyl chloride, 2,4 - bis(trichloromethyl)-, 1980⁸.
- C₁₁H₈NO₂** Acridinic anhydride, 2697².
- C₁₁H₈Br₂NO₂** 1 - (2,3,6 - Tribromo-4,5-dihydroxyphenyl)pyridinium betaine, 1640⁸.
- C₁₁H₈Cl₃N** Quinoline, pentachloro-2,4-dimethyl-, 3621^{1,2}.
- C₁₁H₈Cl₂O₄** 1,3 - Benzodioxan - 6 - carboxylic acid, 2,4 - bis(trichloromethyl)-, 1980⁸.
- C₁₁H₈N₂O₂** Acridinimide, 2697².
- 4,5-β-Naphthimidazoledione, 3904⁴.
- C₁₁H₈NO₂** β-Naphthisoazole, nitro-, 3363⁸.
- 1-Naphthotrile, 2-hydroxy-7-nitro-, 3363⁸.
- C₁₁H₈N₂O** 1-Naphthaldehyde, 2,4-dinitro-, 2268⁸.
- C₁₁H₈Br₂ClNO₂** 1 - (2,3,6 - Tribromo-4,5-dihydroxyphenyl)pyridinium chloride, 1640⁸.
- C₁₁H₈Br₂NO₂** 1 - (2,3,6 - Tribromo - 4,5 - dihydroxyphenyl)pyridinium bromide, 1640⁸.
- C₁₁H₈Cl₂N₂O** Glutaconic anhydride, β-chloro-γ-keto-, γ-phenylhydrazone, 3615⁷.
- C₁₁H₈Cl₂N₂O** 1-Picrylpyridinium chloride, 93⁸.
- C₁₁H₈Cl₂N₂O₂** 6-Isindazolol, 1-acetyl-4,5,7-trichloro-, acetate, 2693⁷.
- C₁₁H₈Cl₂N** Quinoline, tetrachloro-2,4-dimethyl-, 3621^{1,2}.
- C₁₁H₈Cl₂NO₂** 1,3 - Benzodioxan-6-carboxamide, 2,4-bis(trichloromethyl)-, 1980⁸.
- C₁₁H₈NO** Furo[3,2-f]quinoline, and salts, 382⁷.
- β-Naphthisoazole, 3363⁸.
- Naphthotrile, hydroxy-, 1114⁸, 3363⁸.
- C₁₁H₈NO₂** Benzoselenazole, 1-(2-furyl)-, 3055².
- C₁₁H₈NO₄** Acridinic acid, and salts, 2696⁸, 2697^{1,2}.
- 2,4-Quinolinecarboxylic acid, 1815¹.
- C₁₁H₈NS** Isothiocyanic acid, 1-naphthyl ester, 1457⁸.
- C₁₁H₈NS₂** Benzoselenazole, 1-(2-thienyl)-, 3055².
- C₁₁H₈N₂O** 1,3,4-Isonaphthotriazin-2-ol, 3201².
- C₁₁H₈N₂O₂S** 3 - Oxidiazinoindolemercaptan, acetate, 3199⁵.
- C₁₁H₈N₂O₄** 1,2,5 - Triazole - 3,4 - dicarboxylic acid, 1-(p-carboxyphenyl)-, 2690⁸.
- C₁₁H₈N₂O₇** Ether, methyl 1,6,8-trinitro-2-naphthyl, 83⁴, 404⁸.
- C₁₁H₈AgNO₄** 3-Quinolinecarboxylic acid, 2-hydroxy-8-methoxy-, Ag deriv., Ag salt, 377⁸.
- C₁₁H₈AgN₂O₂** α-Toluic acid, α-cyano-2,4-dinitro-, Et ester, Ag deriv., 1257⁸.
- O₁₁H₈Br₂NaO₄** α-Toluic acid, 7-bromo-α-cyano-2,4-dinitro-, Et ester, 1257⁸.
- C₁₁H₈Br₂N₂O₇** Mandelic acid, 7-bromo-α-cyano-2,4-dinitro-, Et ester, 1257⁸.
- C₁₁H₈Br₂N₂O₂S** Diacetanilide, 2,6-dibromo-4-thiocyano-, 1638².
- C₁₁H₈Cl₂NO₂** Ferulic acid, 5-chloro-α-cyano-, 906⁸.
- C₁₁H₈Cl₂N₂O** Pyrazole, chloromethylnitrobenzoyl-, 2899¹.
- C₁₁H₈Cl₂N₂O₄** α-Toluic acid, 7-chloro-α-cyano-2,4-dinitro-, Et ester, 1257⁸.
- C₁₁H₈Cl₂N₂O** Quinoline, dichloro-2,4-dimethylnitro-, 3621^{1,2,3,4}.
- C₁₁H₈Cl₂N₂O₄** 4,5 - Benzmimidazolediol, 6,7-dichloro-, diacetate, 2691⁸.
- 6,7 - Isindazolediol, 4,5-dichloro-, diacetate, 2693⁷.
- C₁₁H₈Cl₂N** Quinoline, trichloro-2,4-dimethyl-, 3621^{1,2}.
- C₁₁H₈Cl₂O₂S** 1,3 - Benzodioxan - 6 - sulfonic acid, 2,4 - bis(trichloromethyl)-, Me ester, 3607¹.
- C₁₁H₈INO₂** Cinchoninic acid, 1,2-dihydro-6-iodo-2-keto-, Me ester, 586².
- C₁₁H₈N₂** 2,9-Pyridindole, 2134⁷.
- C₁₁H₈N₂O₂** Pyridine, (nitrophenyl)-, and salts, 585^{1,3,4,5}.
- 3 - Quinolinenitrile, 2 - hydroxy-8-methoxy-, 377².
- C₁₁H₈N₂O** Acridinamic acid, 2697².
- C₁₁H₈N₂O** Glutaric anhydride, α,β-diketo-, phenylhydrazone, 1798⁸.
- Naphthalene, 1 - methyl - 2,4 (and 4,5)-dinitro-, 2268⁸.
- C₁₁H₈N₂O₄** β-Resorcylnitrile, 5-nitro-, diacetate, 3363⁸.
- C₁₁H₈N₂NaO₂** α-Toluic acid, α-cyano-2,4-dinitro-, Et ester, Na deriv., 1257⁸.
- C₁₁H₈N₂** 1,3,4-Isonaphthotriazine, 2-amino-, 3201².
- C₁₁H₈N₂O** 2-Naphthylamine, N-methyl-1,6,8-trinitro-, 83⁴, 404⁸.
- C₁₁H₈N₂O₂** Pyridine, N-oxide, picrate, 94⁸.
- α-Toluic acid, α-cyano-2,4,6-trinitro-, Et ester, 1257⁸.
- C₁₁H₈O** 1-Naphthaldehyde, P 1272⁸.
- C₁₁H₈O₂** 2-Naphthaldehyde, 1-hydroxy-, 378⁸.
- 1,4-Naphthoquinone, 5-methyl-, 2123⁸.
- 1,4-Pyrene, 2-phenyl-, 2901⁸.
- C₁₁H₈O₂** Naphthoic acid, hydroxy-, P 1660⁸, P 3058⁸.
- Naphthoquinone, methoxy-, 83⁷.
- C₁₁H₈O₄** 1,2 - Benzopyran-4-acetic acid, 2-keto-, 3193⁷.
- C₁₁H₈Br** Naphthalene, 1-(bromomethyl)-, 580⁸.
- C₁₁H₈BrO₂** 2-Furancarboxylic acid, 5-bromo-2,3-dihydro-3-phenyl-, 911⁸.
- C₁₁H₈BrO₂** 2,1 - Benzopyran - 1,3(4) - dione, 5-bromo-7,8-dimethoxy-, 1988⁸.
- C₁₁H₈Br₂NO₄** Salicylaldehyde, 3,5-dibromo-, oxime, diacetate, 92¹.
- C₁₁H₈Cl₂N₂O** Pyrazole, benzoylchloromethyl-, 2899¹.
- C₁₁H₈Cl₂N₂O** Quinoline, chloro-2,4-dimethylnitro-, and sulfate, 3621^{1,2}.
- C₁₁H₈ClO₂** Cinnamyl chloride, p-hydroxy-, acetate, 1257⁸.
- C₁₁H₈Cl₂N** Quinoline, dichloro-2,4-dimethyl-, and salts, 3621^{1,2,3}.
- C₁₁H₈N** Pyridine, phenyl-, 585¹.
- C₁₁H₈NO** 4(1)-Pyridone, 2-phenyl-, 2901⁸.
- 6-Quinolinal, 5-vinyl-, and -HCl, 3197⁸.
- C₁₁H₈NO₂** Naphthoic acid, amino-, P 1127⁸, P 2273⁸, P 2477⁸.
- 3-Pyrrolecarboxylic acid, 2-phenyl-, 3362⁸.
- Quinoline, 3-methyl-6,7-methylenedioxy-, and salts, 585⁸.
- C₁₁H₈NO₂S** 2(1) - Benzofuranone, 1,4-dimethyl-1-thiocyano-, 911⁷.
- C₁₁H₈NO₂** Cinchoninic acid, 1,2-dihydro-2-keto-1-methyl-, 586¹.
- C₁₁H₈NO₄** 1,2,3,4-Pentanetetrone, 1-phenyl-, 2-oxime, 1106⁸.
- 3 - Quinolincarboxylic acid, 2,4-dihydroxy-, Me ester, 2475⁸.
- , 2-hydroxy-8-methoxy-, 377².
- β-Resorcylnitrile, diacetate, 3363⁸.
- C₁₁H₈N₂NaO₄** α-Toluic acid, α-cyano-p-nitro-, Et ester, Na deriv., 1257⁸.

- C₁₁H₉N₃O₂ Spiro[cyclopentane - 1,1' - cyclopropane] - 2',3'-dicarboximide, 2',3'-dicyano-, 2877⁴.
- C₁₁H₉N₃O₄ α -Toluic acid, α -cyano-2,4-dinitro-, Et ester, 1257².
- C₁₁H₁₀ Naphthalene, methyl-, 582², 1645⁶.
- C₁₁H₁₀AsN₂O 2-Pyridol, 5-(3-aminophenyl-arseno)-, P 29077.
- C₁₁H₁₀BrNO₄ 1,2-Indandione, 4-bromo-6,7-dimethoxy-, 2-oxime, 1988⁹.
- α -Veratric acid, 5-bromo-6-(cyanomethyl)-, 1988⁹.
- C₁₁H₁₀BrNaO₂ Δ^2 -2-Butenone, 4-(bromo 4-hydroxy-*m*-anisyl)-, Na deriv., 3609⁴.
- C₁₁H₁₀Br₂O₄ *p*-Toluylhydroquinone, 3,5-dibromo-, diacetate, 3605⁹.
- C₁₁H₁₀ClN Quinoline, 6(7 and 8)-chloro 2,4-dimethyl-, and salts, 3621^{4,9}.
- C₁₁H₁₀ClNO₂ Butyronitrile, γ -chloro- α -hydroxy-, benzoate, 1631².
- C₁₁H₁₀ClNO₇ Pyrazole, chlorodimethyl-, picrate, 2898^{9,10}.
- C₁₁H₁₀Cl₂N₂ Quinoline, aminodichloro-2,4-dimethyl-, 3621^{7,8}.
- C₁₁H₁₀Cl₂N₂O₃ Acetaulide, α -chloro- α -formyl-, *O*-chloroacetyl oxide, 1119⁷.
- C₁₁H₁₀Cl₂NO₃ 1,3,2 - Oxazin - 2 - one, tetrahydro - 4 - hydroxy - 4 - phenyl - 6 - (tri chloromethyl)-, 3614².
- C₁₁H₁₀ClNO₄ Salicylamide, trichlorohydroxyethyl-, acetate, 1867¹.
- C₁₁H₁₀FNO₂S 1 Naphthalenesulfonyl fluoride, 7-cyano-1,2,3,4 tetrahydro-, 3604⁹.
- C₁₁H₁₀IN₃ Pyrazoquinoline, methiodide, 269¹⁰.
- C₁₁H₁₀N₂ Pyridine, 2(3 and 4) (*p*-amino-phenyl), and salts, 585^{2,3,4}.
- C₁₁H₁₀N₂O 2,9-Pyridindole, 1,2,3,4 tetrahydro-1-keto-, 1263⁶.
- 2(1)-Pyrimidone, 1 methyl 5 phenyl, and -HCl, 2259⁸.
- C₁₁H₁₀N₂O₂ 2-Furanhydroxamamide, 1106⁹.
- Quinoline, 2,4 dimethyl 8 nitro-, 3621⁹.
- 8-Quinololinol, 7-acetamide, 1161⁵.
- C₁₁H₁₀N₂O₄ 4,5 - Benzooct - 1,2,6 - oxiazine, 7 hydroxy-, acetate, 1119⁷.
- Hydantoin, 3-acetyl-1-phenyl-, 1795⁴.
- 5-Pyrazolecarboxylic acid, 3-benzyl-4-hydroxy-, 3903⁹.
- C₁₁H₁₀N₂O₄ 4,5 - Benzolept - 1,2,6 - oxiazine, 7-hydroxy-, carboxy deriv., 1119⁷.
- α -Toluic acid, α -cyano-*p*-nitro-, Et ester, 1257².
- C₁₁H₁₀N₂O₅ Glutaric acid, α,β -diketo, α -phenylhydrazine, 1798⁹.
- C₁₁H₁₀N₂O₅S 5-Quinolinesulfonic acid, 7-acetamido-8-hydroxy-, 1461².
- C₁₁H₁₀N₂O₆ Cinnamic acid, α ,3(and α ,4)-dinitro-, Et esters, 399³.
- C₁₁H₁₀N₂S Urea, 1-naphthylthio-, 1457⁶.
- C₁₁H₁₀N₄ 1,2,4-Triazole-1-benzonitrile, 3,5-dimethyl-, 3620⁹.
- C₁₁H₁₀N₄O 3-Indolepropionyl azide, 1263⁹.
- Urea, *s*-di-2-pyridyl-, 941.
- C₁₁H₁₀N₄O₂ Urea, *s*-di-2-pyridylthio-, 944.
- C₁₁H₁₀N₄O₃ 1,2,5 - Triazole - 3,4 - dicarboxamide, 1 (*p*-carbamylphenyl), 2690⁹.
- C₁₁H₁₀O Ether, methyl 2-naphthyl, 82⁹.
- C₁₁H₁₀O₂ α,γ -Pentadienic acid, δ -phenyl-, 1980¹.
- Phthalide, 2-propylidene-, 2260⁷.
- Propiolic acid, phenyl-, Et ester, 3761³.
- C₁₁H₁₀O₃ Benzoic acid, *p*-(γ -keto- Δ^1 -butenyl)-, and Ba salt, 572⁹.
- Coumarin, 4-methoxy-3-methyl-, 3192⁹.
- 2-Furancarboxylic acid, 2,3-dihydro-3-phenyl-, 911².
- 1,2-Naphthalenediol, 4-methoxy-, 83⁹.
- Pyruvic acid, *p*-methylbenzal-, 2882².
- C₁₁H₁₀O₄ 2,2'-Bi[furan] - 3 - carboxylic acid, Et ester, 3362².
- p*-Coumaric acid, acetate, 1257⁹.
- Coumarin, 4,7-dimethoxy-, 3192⁹.
- 11hydrocoumarin, 6-hydroxy-, acetate, 2260⁴.
- C₁₁H₁₀O₅ 2,1-Benzopyran-1,3(4)-dione, 7,8-dimethoxy-, 1988⁹.
- 1,2 - Cyclopropanedicarboxylic acid, 1-hydroxy-3-phenyl-, 901⁴.
- Protocatechualdehyde, diacetate, 11077.
- C₁₁H₁₀O₆ Benzaldehyde, 2,4,6-trihydroxy-, - diacetate, 3195¹.
- C₁₁H₁₀O₇ Protocatechualdehyde, bis(methyl carbonate), 2886⁵.
- C₁₁H₁₀O₈ Gallaldehyde, bis(methyl carbonate), 2886⁵.
- C₁₁H₁₀BrO₂ Δ^1 - 2 - Butenone, 4-(bromo-4-hydroxy *m*-anisyl)-, 3609⁴.
- 1-Indanone, 4-bromo-6,7-dimethoxy-, 1988⁷.
- C₁₁H₁₀BrO₄ Homopiperonylic acid, 6-(bromo-methyl)-, Me ester, 1270⁸.
- Malonic acid, bromophenyl, di Me ester, 238⁴.
- Salicylic acid, bromobutyrate, 1860⁹.
- C₁₁H₁₀BrO₆ Homophthalic acid, 6-bromo-3,4-dimethoxy-, 1988⁹.
- C₁₁H₁₀BrNO 5-Indanamine, *N*-acetyl-4,6-dibromo-, 85⁹.
- C₁₁H₁₀Br₂NO₄ Carbanilic acid, 3,5-dibromo-2-hydroxy-, Et ester, acetate, 1120⁸.
- C₁₁H₁₀Br₂NO₄ Piperidine, 1 (3,5-dibromo-2,4-dinitrophenyl)-, 2681².
- C₁₁H₁₀ClN₂ Pyrazole, benzylchloromethyl-, and -HCl, 2899¹.
- Quinoline, ammochloro - 2,4 dimethyl-, 3621^{4,7}.
- C₁₁H₁₀ClO Pentenyl chloride, β phenyl, 229¹.
- C₁₁H₁₀ClO₂ Cinnamic acid, *o*(and *p*)-chloro-, Et ester, 1133⁹.
- Senecioic acid, *p* chlorophenyl ester, 2126².
- C₁₁H₁₀Cl₂NO Δ^1 -2-Pentenone, 4-dichloroanilino-, 3621².
- C₁₁H₁₀ClO₂ Butyrophenone, γ trichloro- β -hydroxy-*p*-methyl-, 3614².
- C₁₁H₁₀ClO₄ Benzoic acid, 4-ethoxy-3 (β -trichloro- α -hydroxyethyl)-, 1980⁸.
- C₁₁H₁₀HgNO₂ Metaphen, P 917¹, 1690¹.
- C₁₁H₁₀IN₄ Triazolo[3-*c*]quinoline, 3-methyl, methiodide, 2690¹.
- C₁₁H₁₀NO Quinaldine, 8-methoxy-, chloroaurate, 377¹.
- Quinoline, 6-methoxy 3 methyl, and salts, 585⁷.
- C₁₁H₁₀NO₂ 3-Indolepropionic acid, 90¹, 583⁹.
- 5(4) Oxazolone, 4-benzyl 2-methyl-, 61⁴.
- Propiophenone, 55⁹.
- 2,4-Quinolinediol, 3-ethyl-, 1987⁴.
- Succinimide, *N* benzyl, 73¹.
- 2,4 - Xylonitrile, 6-hydroxy-, acetate, 3363⁹.
- C₁₁H₁₀NO₂S 2,4-Thiazolodione, 5-ethyl-3-phenyl-, 245⁷.
- C₁₁H₁₀NO₃ Cinchoninic acid, 1,2,3,4 tetrahydro-2-keto-, Me ester, 586¹.
- , 1,2,3,4-tetrahydro - 2 - keto - 1 - methyl-, 586¹.
- Ketone, methyl 4 nitro-5-indanyl, 85¹.
- 3-Pyrrolecarboxylic acid, 2-(2-furyl)-, Et ester, 3362².
- C₁₁H₁₀NO₃S Benzenesulfonic acid, pyridine addn. compd., 573⁴.

- C₁₁H₁₁NO₄** Cinnamaldehyde, 5-methoxy- α -methyl-2-nitro, 5857.
Cinnamic acid, nitro-, Et ester, 1453⁹.
2-Indolecarboxylic acid, 5,6-dimethoxy-, 1649⁹.
- *C₁₁H₁₁NO₇** Pyruvic acid, (2-nitro-4,5-dimethoxyphenyl)-, 1649⁸.
- C₁₁H₁₁N₃** Guanidine, α -1-naphthyl, and -HNO_2 , 1463⁸.
Pyridine, 2(3 and 4)-(p-hydrazinophenyl)-, and salts, 585^{2,3,4}.
Pyrrole, methylphenylazo, 2451³.
- C₁₁H₁₁N₃OS₂** Δ^2 - 1,3,4 - Thiodiazoline, 4-acetyl - 2 - methylmercapto-5-phenylimino-, 3199⁸.
- C₁₁H₁₁N₃O₂** 1,2,4 - Triazole-1- β -benzoic acid, 3,5-dimethyl-, 3620⁶.
- C₁₁H₁₁N₃O₂S** 1,3,4 - Oxidiazole, 3-acetyl-2,3-dihydro - 5-methylmercapto - 2 - phenylimino-, 3200².
- C₁₁H₁₁N₃O₃** 5 - Benzimidazolecarboxylic acid, 7-acetamido-2-methyl-, 1813⁸.
- C₁₁H₁₁N₃O₄** p-Acetophenetide, 3-cyano-2-nitro, 2260⁹.
3(4) - Quinazolinecarbamie acid, 1,2-dihydro 2,4 diketone, Et ester, 2697⁸.
- C₁₁H₁₁N₃O₆** Phthalide, 6-(p-acetylhydrazino)-5-methoxy-3-nitro-, 3358².
- C₁₁H₁₁N₃O₇** Hydrocinnamic acid, β hydroxy- α ,3(and α ,1) - dinitro-, nitrate, Et ester, 399^{8,9}.
- C₁₁H₁₁N₃OS** Δ^2 - 1 - Pyrazolinecarboxamide, 5 - keto - 3 - methyl - 4 - phenylazothio-, 2128⁸.
- C₁₁H₁₁N₄O₂** Δ^2 - 1 - Pyrazolinecarboxamide, 5-keto 3 methyl-4-phenylazo-, 2128⁸.
- C₁₁H₁₁N₄O₇** Pyrrole, 2-(aminomethyl)-, picrate, 871.
- C₁₁H₁₁BrClO₂** Isovaleric acid, α bromo-, p-chlorophenyl ester, 2126⁴.
- C₁₁H₁₁BrClN** Propionimidyl chloride, α -bromo α -chloro-N-phenethyl-, 2875⁷.
- C₁₁H₁₁BrNO** 5-Indanamine, N-acetyl-6-bromo-, 843⁸.
- C₁₁H₁₁BrNO₂** 1-Indanone, 4-bromo-6,7-dimethoxy, oxime, 1988⁷.
- C₁₁H₁₁BrNO₄** Acetophenone, 5-bromo-2-hydroxy-4-methoxy-, acetylloxime, 3363⁹.
- C₁₁H₁₁ClNO** Δ^2 2-Pentenone, 4-o (m and p)-chloroanilino-, 3621¹.
- C₁₁H₁₁ClNO₂** m-Acetotoluide, 4-chloroacetyl-, 2884².
- C₁₁H₁₁ClN₂O** 1(2) - Naphthalenone, 7-chloro-3,4-dihydro-, semicarbazone, 1123⁶.
- C₁₁H₁₁ClN₂O₄** Piperidine, 1-(5-chloro-2,4-dinitrophenyl)-, 2681⁴.
- C₁₁H₁₁Cl₂N₂O** Antipyrine, dichloro-, 2687⁶.
- C₁₁H₁₁Cl₂N₂O₂** Piperidine, 1-(4,5-dichloro-2-nitrophenyl)-, 2681¹.
- C₁₁H₁₁HgO₆** o-Cresol, 4,6-bis(acetoxymethyl)-, 1253¹.
- C₁₁H₁₁N₂** 2,9-Pyridindole, 1,2,3,4-tetrahydro-, 3622⁸.
Quinoline, 8-amino-2,4-dimethyl-, and $\text{-H}_2\text{SO}_4$, 3622¹.
- *C₁₁H₁₁N₂O** (See also *Antipyrine*.)
Butyramide, α -cyano- γ -phenyl-, 228⁷.
Compd., m. 201⁹, from 2-benzoyloxy-2-methyl - 5 - phenyl - 3(2) - pyrrolone and NH₃, 1106⁴.
p-Cresol, 2-[5(or 3)-methyl-3(or 5)-pyrazolyl]-, 2472².
2(3) - Imidazolone, 1,3-dimethyl-4-phenyl-, and -HCl , 3353⁸.
- Vasine, 2900⁹.
- C₁₁H₁₁N₂OS₂** 1,1,3 - Isothiodiazine, 2-(benzylmercapto)-5-methoxy-, 3834¹.
1,4,3 - Isothiodiazin-5-ol, 2-(benzylmercapto)-6-methyl-, 383⁸.
- C₁₁H₁₁N₂O₂** (See also *Tryptophan*.)
Propionitrile, α -(p-hydroxyanilino)-, acetate, 1794¹.
- C₁₁H₁₁N₂OS** Acetic acid, (2-benzimidazolylmercapto)-, Et ester, 245⁸.
- C₁₁H₁₁N₂O₃** Glyoxime, phenyl-, Me deriv., Ac deriv., 1098⁷.
Hydantoin, 1-anisyl 3-methyl-, 1795⁴.
—, 5 - hydroxy - 1,3 - dimethyl-5-phenyl-, 3353⁹.
5 - Indanamine, N-acetyl 4-nitro-, 843⁸.
Ketone, methyl 4-nitro-5-indanyl, oxime, 851¹.
3-Pyrrolecarboxylic acid, 5-cyanoacetyl-2-methyl-, Et ester, 3814¹.
Urea, α -benzoyl - β -formyl α,β -dimethyl-, 3353⁹.
- C₁₁H₁₁N₂O₄** Acetanilide, o-formyl-, O-carbomethoxyoxime, 1119².
Carbamlic acid, N-acetyl-o-formyl(?), Me ester, oxime, 1119⁶.
—, o-formyl-, Me ester, O-acetylloxime, 1119².
Glutaconic acid, α,γ dicyano-, di Et ester, 1248⁸, *derms.*, 3800¹.
- C₁₁H₁₁N₂O₅** Carbanilic acid, o-formyl-, Me ester, O-carbomethoxyoxime, 1119¹.
- C₁₁H₁₁N₂O₆** Acetophenone, 2-hydroxy-4-methoxy-5-nitro-, acetylloxime, 3363⁹.
- C₁₁H₁₁N₂O₇** 1,2,3-Benzotriazole, 7-acetamido-1-acetyl-5-methyl-, 1813⁸.
- C₁₁H₁₁N₄O** 1-Pyrazol[1,5- γ]quinolinecarboxylic acid, 2,3,3i,1,5,9i-hexahydro-3-keto-, Me ester, 1124¹.
- C₁₁H₁₁N₄OS** 1,1-Thiopyrone, tetrahydro-, 2,1-dinitrophenylthio-, 1262⁸.
- C₁₁H₁₁N₄S** Compd., m. 116-7⁹, from dimethylphenylthiazole and HCN, 3200⁶.
- C₁₁H₁₂O** Pentenone, phenyl-, 228⁶, 229⁹.
- C₁₁H₁₂OS₂** 1,3-Benzodithiole, 2-acetyl-2-methyl-, 72⁹.
- C₁₁H₁₂O₂** 2(1)-Benzofuranone, 1,1,6-trimethyl-, 1117².
 β -Butenic acid, β -phenyl-, Me ester, 228⁹.
 Δ^2 2-Butenone, 4-(p-hydroxyphenyl)-3-methyl-, 1803³.
4-Chromanone, 3,8-dimethyl-, 1117⁶.
Cinnamic acid, α,β -6-dimethyl-, 1123⁶.
—, Et ester, 557, 1153⁹, 3047⁶.
Hydrocinnamic acid, β (α -hydroxyethyl)-, lactone, 2291¹.
1(2)-Naphthalenone, 3,4-dihydro-7-methoxy-, 1123⁶.
Pentenic acid, β phenyl-, 228⁹.
Senecioic acid, Ph ester, 2126².
Seneciophenone, o-hydroxy-, 2126⁴.
- C₁₁H₁₂O₃** Δ^2 2-Butenone, 4-(3-hydroxy-p-anisyl)-, 1449⁸.
1,3 - Dioxolan-4-one, 2,2-dimethyl-5-phenyl-, 1798².
Guaiacol, 4-vinyl-, acetate, 3050¹.
Isomyristicin, 2256⁷.
Myristicin, 2256⁷.
- C₁₁H₁₂O₃Si** Xanthic acid, p-carboxymethylmercapto-phenyl ester, 1090⁸.
- C₁₁H₁₂O₄** Glycolic acid, 4-vinyl-o-anisyl ester, 3050¹.

- Glyoxylic acid, (4,6-dimethyl-*o*-anisyl)-, 1117¹.
 —, (5-methyl-*o*-phenetyl)-, 1117¹.
 C₁₁H₁₃O₅ Homopiperonylic acid, 6-(methoxy-methyl)-, and *Ag* salt, 1270².
 C₁₁H₁₃O₅ Benzoic acid, 4-carbomethoxy-3-methoxy-, 93¹.
 C₁₁H₁₃O₇ Protocatechuy alcohol, bis(methyl carbonate), 2886¹.
 Veratric acid, 5-carbomethoxyoxy-, 78⁵.
 C₁₁H₁₃S₂ 2-Naphthoic acid, dithio-, Et ester, 3609¹.
 C₁₁H₁₃Br Indan, 1-(β-bromoethyl)-, 84¹.
 C₁₁H₁₃BrClNO Propionamide, α-bromo-α-chloro-*N*-phenethyl-, 2875⁷.
 C₁₁H₁₃BrN₂O₂ Piperidine, 1-(4-bromo-2-nitrophenyl)-, 2681¹.
 C₁₁H₁₃BrN₂S Benzothiazole, 5-bromo-1-butylamino-, 584¹.
 —, 5-bromo-1-isobutylamino-, 584¹.
 C₁₁H₁₃BrO₂ Isovaleric acid, α-bromo-, Ph ester, 2126¹.
 C₁₁H₁₃BrO₂ 2-Benzofuranpropionic acid, 2-bromooctahydro-2a-hydroxy-1-keto-lactone, 3054¹.
 Hydrocinnamic acid, 2-bromo-4,5-dimethoxy-, 1988⁷.
 C₁₁H₁₃BrN₂S Benzothiazole, 5-bromo-1-butylamino-, dibromide, 584¹.
 —, 5-bromo-1-isobutylamino-, dibromide, 584¹.
 C₁₁H₁₃ClHgO₂ 4,3-Cresotaldehyde, 5-(chloromercuri)-6-isopropyl-, 70¹.
 C₁₁H₁₃ClINO₂ Acetic acid, chloroiodo-, 1-amino-1-indanol salt, 1963⁹.
 C₁₁H₁₃ClN₂O₂ Piperidine, 1-(2-chloro-4-nitrophenyl)-, 2681¹.
 C₁₁H₁₃ClN₂O₅ Uric acid, 1-acetyl-4-chloro-4,5-dihydro-5-hydroxy-3,9-dimethyl-, acetate, 3352¹.
 C₁₁H₁₃ClO₂ Hydrocinnamic acid, *p*-chloro-, Et ester, 1453⁸.
 C₁₁H₁₃ClO₂ Hydrocinnamic acid, α-chloro-β-ethoxy-, 3051¹.
 C₁₁H₁₃IO₂ Cresotaldehyde, iodoisopropyl-, 70¹.
 C₁₁H₁₃NO₂ Butyronitrile, *γ*-benzyl-, 1639².
 Formamide, tetrahydronaphthyl-, 1678¹.
 Hydrocarbostyryl, dimethyl-, 1979¹.
 —, 1-ethyl-, 1979¹.
 4-Indanamine, *N*-acetyl-, 85².
 C₁₁H₁₃NO₂ Acetamide, *N*-(α-acetylbenzyl)-(?), 3900².
 Acrylic acid, β-anilino-, Et ester, 55¹.
 Δ²-2-Butenone, 4-amino-4-(2,5-cresyl)-, 2471¹.
 —, 4-(*p*-hydroxyphenyl)-3-methyl-, oxime, 1803⁸.
 Cinnamic acid, *p*-dimethylamino-, 1107⁵.
 Crotonophenone, β-amino-2-hydroxy-5-methyl-, 2472¹.
 Δ²-Cyclohexene-Δ¹.α-acetic acid, α-cyano-3-methyl-, Me ester, 1103⁸.
 Diacetamide, *N*-benzyl-, 73¹, 3900¹.
 Naphthaldehyde, 5,6,7,8-tetrahydrohydroxy-, oxime, 1983⁷.
 2-Naphthoic acid, 3-amino-5,6,7,8-tetrahydro-, 1123¹.
o-Phenyldienimine, 2,4-diacetyl-5-methyl-, 2872².
 C₁₁H₁₃NO₃ Hippuric acid, *γ*-thio-, Et ester, 98².
 C₁₁H₁₃NO₃ Acetophenone, 2-hydroxy-5-methyl-, acetyloxime, 92¹.
 Anisamide, *N*-acetyl-*N*-methyl-, 75¹.
 Butyric acid, *γ*-benzamido-, 258¹.
 Hydrastinine, 2669¹.
 1(2)-Isosquinalone, 3,4-dihydro-6,7-dimethoxy-, *deriv.*, 1817¹.
 Propionic acid, *p*-phenetidine salt-, 56¹.
 2,4-Xylaldehyde, 6-hydroxy-, oxime, acetate, 3363².
 C₁₁H₁₃NO₄ (See also *Neurodine*; *Thermidine*.)
 Acetophenone, 2-hydroxy-4-(and 5)-methoxy-, oxime, Ac deriv., 3363².
 Butyric acid, *γ*-benzamido-β-hydroxy-, 258¹, 3892².
 Carbanilic acid, *o*-hydroxy-, Et ester, acetate, 1120⁷.
 Glycine, *N*-homopiperonyl-, -HCl, 1461¹.
 Hydrocinnamic acid, β-methylamino-3,4-methylenedioxy-, and -HCl, 1257¹.
 C₁₁H₁₃NO₅ Acetophenone, 3,4,5-trimethoxy-2-nitro-, 912¹.
 C₁₁H₁₃N₂O Benzimidazole, acetamidodimethyl-, 2691⁷; and salts, 1813⁷.
 3-Indolepropionic acid, hydrazide, 1263¹.
 C₁₁H₁₃N₂O₃ 1,2,4-Triazol-5(4)-one, 1-methyl-3-(methylmercapto)-4-(tolyl)-, 2900¹.
 C₁₁H₁₃N₂O₂ *p*-Acetophenetide, 2-amino-3-cyano-, 2260¹⁰.
 2(1)-Benzofuranpne, 4,6-dimethyl-, semicarbazone, 1117⁷.
 2-Pyrrolidone, 1-carbamido-5-phenyl-, 2897².
 C₁₁H₁₃N₂O₂ Propionic acid, β-benzoyl-, semicarbazone, 2897².
 C₁₁H₁₃N₂O₃ Carbanilic acid, *o*-(acetamidocarbamyl)-, Me ester, and -HCl, 2697¹.
 Urea, (*o*-formylphenyl)-, *O*-carbomethoxy-, 1119¹.
 C₁₁H₁₃N₂O₂ Carbanilic acid, *o*-(carboxyamino-carbamyl)-, di-Me ester, 2697¹.
 C₁₁H₁₃N₂S₂ Δ²-1,3,4-Thiodiazoline, 2-methylmercapto-5-xylylimino-, 3200¹.
 C₁₁H₁₃AsBrN₂O₂ Arsanilic acid, *N*-[*N*-(α-bromopropionyl)glycyl]-, 71².
 C₁₁H₁₃AsN₂O₂ Carbanilic acid, [(*p*-arsonophenylcarbamyl)methyl]carbamylmethyl-, 71¹.
 C₁₁H₁₃BrN Benzylamine, *N*-(β-bromoallyl)-*N*-methyl-, and -HCl, 53¹.
 C₁₁H₁₃BrNO Propionamide, α-bromo-*N*-phenethyl-, 1657¹.
 C₁₁H₁₃BrNO₂ 3-Indolepropionic acid, 3-bromooctahydro-3a-hydroxy-2-keto-, δ-lactone, 3054².
 C₁₁H₁₃BrN₂S Benzothiazole, 1-butylamino-, dibromide, 584¹.
 —, 1-isobutylamino-, dibromide, -HBr, 584².
 C₁₁H₁₃BrN₂O₂ Benzothiazole, 1-dimethylamino-5-ethoxy-, tetrabromide, 2688⁷.
 C₁₁H₁₃ClN Benzylamine, *N*-(*γ*-chloroallyl)-*N*, methyl-, 53¹.
 C₁₁H₁₃ClNO Butyranilide, β-chloro-*N*-methyl-, 1979¹.
 Butyrololuide, β-chloro-, 1979⁷.
 Carbanilic chloride, *N*-butyl-, 1108¹.
 —, *N*-isobutyl-, 1108¹.
 Propionanilide, β-chloro-*N*-ethyl-, 1979¹.
 C₁₁H₁₃ClNO₂ *p*-Propionophenetide, β-chloro-, 1979¹.
 C₁₁H₁₃ClN₂ 1,2,4-Triazole, 3,5-dimethyl-1-phenyl-, methochloride, and salts, 3200¹.
 C₁₁H₁₃ClN₂O₂ Acetoacetic acid, Et ester, 6-chloro-3-pyridylhydrazone, 1814⁷.
 C₁₁H₁₃ClN₂O₂ Isobutyrophenone, 5-chloro-α,2-dihydroxy-, semicarbazone, 1117².

- $C_{11}H_{11}N_3$ 1,2,4-Triazole, 3,5-dimethyl-1-phenyl-, methiodide, 3200⁶.
- $C_{11}H_{11}N_3O$ (See also *Cytisine*.)
7,8-Benzoseptamethylenimine, nitroso-, 2696².
as - Homotetrahydroisoquinoline, 8-methyl-nitroso-, 1461².
Naphthylidine, acetyl(tetrahydromethyl-, 586².
Nicotinic acid, piperidine, P 250⁸.
- $C_{11}H_{11}N_3O_2$ Benzothiazole, 1-dimethylamino-5-ethoxy-, 2688².
Urea, (5,6,7,8 - tetrahydro-3-hydroxy-2-naphthyl)thio-, 1983².
- $C_{11}H_{11}N_3O_2$ Biacetyl, *p*-anisylhydrazone, 1973².
2-Butanone, oxime, carbanilate, 1628².
Hydrocinnamide, α -acetamido-, 61².
Isovaleric acid, α -keto-, phenylhydrazone, 1966².
Urea, (5,6,7,8 - tetrahydro-3-hydroxy-2-naphthyl-), 1983².
- $C_{11}H_{11}N_3O_2$ Glycine, *N*- β -phenylalanyl-, 378².
 $C_{11}H_{11}N_3O_2S$ 2 - Benzimidazolemethanesulfonic acid, α -propyl-, and *Ba salt*, 3601².
 $C_{11}H_{11}N_3O_2$ Tyrosine, *N*-glycyl-, 2260².
 $C_{11}H_{11}N_3O_2S$ 1 - Naphthalenesulfonamide, 1,2,3,4-tetrahydro - *N* - methyl-2-nitro-, 3604².
- $C_{11}H_{11}N_3O_2$ Ethanol, 2-(methoxymethylamino)-, *p*-nitrobenzoate, 2249².
 $C_{11}H_{11}N_3O_2$ 2-Pyrrolidinedicarboxylic acid, 1,1'-methylenebis[5-keto-, 3044²].
 $C_{11}H_{11}N_3S$ Benzothiazole, 1-butylamino-, 584².
—, 1-isobutylamino-, 584².
 $C_{11}H_{11}N_4O_2$ 4 - Cinnolinebicarbamie acid, 1,2,3,4-tetrahydro-, Me ester, *K salt*, 1124¹.
 $C_{11}H_{11}N_4O_2$ Guanidine, α -butyryl, picrate, 62².
—, α -isobutyryl-, picrate, 62².
 $C_{11}H_{11}O$ Anisole, *o* (Δ^2 -butenyl), 396².
Benzofuran, 1,2 - dihydro - 1,4,6 - tri-methyl, 71².
2-Butanone, 3-*p*-tolyl-, 3051².
Ether, allyl 2,4-xylyl, 71².
Ethylene oxide, α , α -dimethyl- β -*p*-tolyl-, 3051².
—, (γ -phenylpropyl)-, 59², 3899⁷.
Isovalerophenone, 908².
 α -Tolualdehyde, p , α , α -trimethyl-, 3051².
Valerophenone, 908².
2,4-Xylenol, 6-allyl-, 71².
—, 6-propenyl-, 71².
- $C_{11}H_{11}O_2$ Acetophenone, 4-hydroxy-3-propyl-, 1974².
Acetophenone, *p*-isopropoxy-, 81².
Benzoic acid, *p*-ethyl-, Et ester, 1453².
Benzyl alcohol, α -ethyl-, acetate, 2938².
Butyropheneone, β -methoxy-, 3901².
Guaiacol, 4- Δ^2 -butenyl-, 1803².
Hydratropic acid, Et ester, 1581¹.
Hydrocinnamic acid, α -ethyl-, 1123².
—, Et ester, 1453².
Isobutyric acid, α -tolyl ester, 1117².
Isobutyropheneone, 2(and 4) - hydroxy - methyl-, 1117².
 Δ^1 - 3 - Pentenone, 1-(2-furyl)-4,4-dimethyl-, 86².
Phenethyl alcohol, α -methyl-, acetate, 2938².
Phthalide, 4,5-dihydro-2-propyl-, 2261¹.
1-Propanol, 3-phenyl-, acetate, 2938².
 α -Toluic acid, *p*-methyl-, Et ester, 1453².
Valeric acid, δ -phenyl-, 3020².
Veratrole, 4-propenyl-, 55².
- $C_{11}H_{11}O_2$ Acetic acid, *m*-tolyl-oxo-, Et ester, 1253².
Benzaldehyde, 4-isopropoxy-3-methoxy-, 3612².
—, 3-methoxy-4-propoxy-, 3612².
Homoanisic acid, Et ester, 1453².
Isozingerone, 1449².
- $C_{11}H_{11}O_2$ 2-Camphanecarboxylic acid, 5,6-diketo-, 401².
 Δ^2 - Cyclopentenemalonie acid, α -allyl-, 901².
Glutaric acid, α -(dihydrophenyl)-, 3054².
Hydrocinnamic acid, 2,5-dimethoxy-, and *Ba salt*, 2260².
 $C_{11}H_{11}O_2$ 2-Benzofuranpropionic acid, octahydro-2,2a-dihydroxy - 1 - keto-, γ -lactone, 3054¹.
 α -Toluic acid, 2,4,6-trimethoxy-, 1120².
- $C_{11}H_{11}O_2$ Glutaconic acid, α , γ -diacetyl-, di-Me ester, 1260⁷.
 $C_{11}H_{11}As_2N_2O_2$ Benzenearsenic acid, 3-nitro 4-(1-piperidyl)-, and *Ba salt*, 2694².
 $C_{11}H_{11}As_2N_2O_2$ Carbamic acid, [(*p* - arsono-phenyl)carbamyl]methyl-, Et ester, 70².
 $C_{11}H_{11}As_2NO_2$ Acetic acid, [*p*-(γ -hydroxy-propyl)aminophenyl]arseno-, -HCl, 1628².
 $C_{11}H_{11}As_2NO_2$ Acetic acid, 4-hydroxypropyl-aminophenyltetraarseno-, 1628².
 $C_{11}H_{11}Br$ Benzene, [β -(bromomethyl)butyl]-, 1123².
—, (γ - bromo - α - methylisobutyl)-, 1123².
Cumene, *p* - (β - bromomethyl)-, 1461².
- $C_{11}H_{11}BrN_2O_2$ (See also *Permethon*.)
Barbituric acid, 5- β -bromoallyl - 5 - *sec*-butyl-, P 250⁷.
 $C_{11}H_{11}BrN_2S$ Urea, α -(*p* bromophenyl)- β -butylthio, 584².
—, α - (*p* - bromophenyl)- β -isobutylthio-, 584².
- $C_{11}H_{11}BrO_2$ 1 - Norcamphanecarboxylic acid, 2 - (bromomethylene) - 3,3 dimethyl-(?), 401².
- $C_{11}H_{11}BrO_2$ Guaiacol, 4-(β -bromo α -methoxy-propyl)-, 1256¹.
- $C_{11}H_{11}BrO_2$ 2-Benzofuranpropionic acid, 2 bromooctahydro - 2a - hydroxy-1-keto-, 3053².
- $C_{11}H_{11}BrO_2$ Arabinose, acetobromo-, 2121¹.
- $C_{11}H_{11}Br_2O_2$ (Glutaric acid, α , γ -dibromo- β -(bromocarboxymethyl) - β - methyl-, tri-Me ester, 1444¹.
 $C_{11}H_{11}ClO$ Ether, benzyl δ -chlorobutyl-, 1639^{1,2}.
 $C_{11}H_{11}ClO_2$ Guaiacol, 5-(γ -chlorobutyl)-, 1449².
 $C_{11}H_{11}N$ 7,8 - Benzoheptamethylenimine, and -HCl, 2695², 2696².
as - Homotetrahydroisoquinoline, 8-methyl-, and -HCl, 1461².
Naphthylamine, tetrahydromethyl-, 1678².
1 - Norcamphanenitrile, 3,3-dimethyl-2-methylene-, 401².
Quinoline, tetrahydrodimethyl-, 2696^{2,3}.
- $C_{11}H_{11}NO$ 2-Butanone, 3-*p*-tolyl-, oxime, 3051².
Propiophenone, β -dimethylamino-, -HCl, 1121².
 α -Tolamide, α -isopropyl-, 1840².
- $C_{11}H_{11}NO_2$ (See also *Butesin*.)
Benzene, 1 - (β - methylbutyl)-4-nitro-, 1801².
Benzoic acid, *p*-amino-, Bu ester, P 2478².
Glycine, methylphenethyl-, and -HCl, 1460^{2,3}.
Isobutyropheneone, 2-hydroxy-5-methyl-, oxime, 1117².
Phenacetin, methyl-, 1678².
- $C_{11}H_{11}NO_2$ (See also *Cryofin*; *Lactophenine*.)

- Cyclohexanecarboxylic acid, α -cyano-3-keto-1-methyl-, Me ester, 1103⁸.
 Isozingerone, oxime, 1449⁶.
 2-Pyrroleacetic acid, α -keto-3,4,5-trimethyl-, Et ester, 85⁶.
 2-Pyrrolecarboxylic acid, 3-ethyl-4-formyl-5-methyl-, Et ester, 1041.
 Zingerone, oxime, 1449⁷.
 C₁₁H₁₆NO₄ 2-Camphanecarboxylic acid, 5,6-diketo-, 5-oxime, 4021.
 3-Indolepropionic acid, octahydro-3,3a-dihydroxy-2-keto-, γ -lactone, 3054².
 C₁₁H₁₆NO₄ 1-Butanesulfonic acid, 1-phenylcarbamyl-, and salts, 3601².
 Valeric acid, γ -phenylsulfonamido-, 258².
 C₁₁H₁₆NO₄ Veratrole, 4-(α -methoxy β nitroethyl)-, 1655⁶.
 C₁₁H₁₆N₂ Isocyanic acid, Ph ester, diethyl hydrazone, 570⁴.
 C₁₁H₁₆N₂O Acetophenone, 2,5-dimethyl-, semicarbazone, 3611³.
 Butyrophenone, semicarbazone, 908⁸.
 Isobutyrophenone, semicarbazone, 229⁵.
 1(2) - Quinoxalinecarboxamide, 3,4 dihydro-2,3-dimethyl-, 1653⁷.
 C₁₁H₁₆N₂O₂ Isobutyrophenone, α -hydroxy, semicarbazone, 3611⁷.
 C₁₁H₁₆N₂O₃ Crotonic acid, β [(4,5-dihydro 5-keto-3-methyl-1-pyrazolyl)thioformamido]-, Et ester, 2128⁶.
 C₁₁H₁₆N₂O₄ Aniline, *N*-amyl-2,4-dinitro-, 401⁸.
 —, *N*-isoamyl-2,4-dinitro-, 404⁸.
 Crotonic acid, β - [(4,5-dihydro 5-keto-3-methyl-1-pyrazolyl)formamido]-, Et ester, 2128⁹.
 C₁₁H₁₆N₂O₅ Semicarbazone, decomps. 211⁸, of ketodicarboxylic acid from 1,4,5 tri methyl - Δ^3 - cyclopentenedicarboxylic acid, 1250⁴.
 C₁₁H₁₆ Benzene, (β -methylbutyl), 1801⁵.
 C₁₁H₁₆AsN₃O₄ Arsanilic acid, A (*N*-alanilyl-glycyl)-, 71².
 C₁₁H₁₆BrNO 1 - Norcamphanecarboxamide, 2 - (bromomethylene) - 3,3 - dimethyl-, 401⁷.
 C₁₁H₁₆BrNO₃ *m* - Toluenesulfonamide, 5-bromo-*N*, *N*-diethyl-6-hydroxy⁸, 3605³.
 C₁₁H₁₆BrNO₄ 3-Indolepropionic acid, 3-bromo-octahydro-3a-hydroxy 2-keto-, 3054¹.
 C₁₁H₁₆BrP Allyldimethylphenylphosphonium bromide, 66⁸.
 C₁₁H₁₆Br₂O₂ Norcamphanecarboxylic acid, 1-bromo(bromomethyl)dimethyl-, 401⁷ ⁸.
 C₁₁H₁₆Br₂O₃ Cyclohexanecarboxylic acid, 5,5-dibromo-4-keto-2,2,3-trimethyl, Me ester, 1259¹.
 C₁₁H₁₆ClN 2-Camphanenitrile, 2-chloro-, 401⁸, 1808⁸.
 C₁₁H₁₆ClNO Allylethylhydroxyphenylammonium chloride, 65⁴.
 C₁₁H₁₆IN 1,2,3,4-Tetrahydro-2,7-dimethylisoquinolinium iodide, 1461¹.
 C₁₁H₁₆N₂O Benzoic acid, diethylhydrazide, 570⁴.
 Hydrocinnamamide, α amino - *N* - ethyl-, 378¹.
 Nicotinamide, *N*-ethyl-*N*-propyl-, P 250⁸.
 Propionamide, α - amino-*N*-phenethyl-, 1657⁸.
 C₁₁H₁₆N₂O₃ Urea, α , α -dimethyl- β - β -phenethylthio-, 2688⁸.
 C₁₁H₁₆N₂O₂ (See also *Pilocarpine*.)
 2-Indazolecarboxylic acid, tetrahydro methyl-, ethyl ester, 2900⁴.
 1-Isosindazolecarboxylic acid, tetrahydro methyl-, ethyl ester, 2900⁴.
 Urea, α - ethoxy - α - ethyl - β - phenyl-, 2249².
 —, [γ - (*p* - hydroxyphenyl)-*sec*-butyl]-, 1449⁷.
 C₁₁H₁₆N₂O₃ Barbituric acid, 5-allyl-5-butyl-, P 250⁷, P 916⁸, P 2907⁸.
 Butyric acid, α , β -dihydroxy-, *o*-tolylhydrazide, 3350⁸.
 C₁₁H₁₆N₂O₃ α - Toluenesulfonamide, *N*, *N*-diethyl-*o*(*m* and *p*)-nitro-, 2254⁷.
 C₁₁H₁₆N₂O₃ Glutaconic acid, α , γ -dicarbamyl-, di-Et ester, -*II*Br, 1248⁸.
 C₁₁H₁₆N₂O₇ Glutamic acid, *N*-[(2-carboxy-5-keto-1-pyrrolidyl)methyl]-, 3044⁸.
 C₁₁H₁₆N₂S Urea, α -butyl- β -phenylthio-, 584².
 C₁₁H₁₆N₄O Acetone, 4 (*N*-methylanilino)-semicarbazone, 691.
 —, 4-*p*-toluinesemicarbazone, 691.
 C₁₁H₁₆N₃O Propylamine, *N*, *N*-dimethyl-, picrate, 2660⁸.
 C₁₁H₁₆N₃O Guanidine, α , α -diethyl-, picrate, 1163⁸, 2878⁸.
 —, γ - ethyl α , α - dimethyl-, picrate, 62⁹.
 —, α , α , γ , γ tetramethyl-, picrate, 2878⁷.
 C₁₁H₁₆O Benzyl alcohol, α -butyl-, 72⁸.
 1-Butanol, 2-benzyl-, 1123⁷.
 —, β methyl γ -phenyl-, 1123⁷.
 Ether, isoamyl phenyl, 3897⁸.
 —, phenethyl propyl, 3608⁸.
 Phenethyl alcohol, isopropyl-, 1461², 1640⁴.
 2,4 Xylenol, 6-propyl-, 71⁸.
 C₁₁H₁₆O₂ 2-Bornylencarboxylic acid, 1808⁸.
 1-Butanol, 4 benzyloxy-, 1639¹.
 Camphenoxydicarboxylolactone (?), 401⁶.
 Homocamphenilone, hydroxymethylene-, 2891⁴.
 2 - Norcamphanecarboxylic acid, 5,5-dimethyl-6-methylene-, 401⁴.
 1,2-Pentanediol, 5 phenyl-, 59².
 C₁₁H₁₆O₄ 2-Butanol, 4-(3 hydroxy *p*-anisyl)-, 1449⁸.
 2-Camphanecarboxylic acid, 6-keto-, 401² ⁹.
 2 Camphenoxydicarboxylic acid, 401⁸.
 1,2 - Cyclopentanedicarboxylic anhydride 2,3,3,4-tetramethyl-, 402¹.
 C₁₁H₁₆O₃ α -Toluenesulfonic acid, α -butyl-, 52⁷.
 C₁₁H₁₆O₄ Δ^3 - Cyclohexenecarboxylic acid, 4-hydroxy - 5 - keto - 2,2,3 - trimethyl-, Me ester, 1259¹.
 Δ^2 - Cyclopentenemalonic acid, α -isopropyl-, 901³.
 —, α propyl-, 901⁵.
 2,6 - Norcamphanedicarboxylic acid, 5,5-dimethyl-(?), 401⁵.
 C₁₁H₁₆O₆ 2 - Benzofuranpropionic acid, octahydro - 2,2a - dihydroxy - 1 - keto-, 3054¹.
 Glutaric acid, α , α -dihydroxy- β , β , γ , γ -tetramethyl-, γ -lactone, acetate, 1967⁷.
 C₁₁H₁₆O₈ Arabinose, triacetyl-, 2121⁴.
 C₁₁H₁₆S Benzyl mercaptan, α -butyl-, 52⁷.
 C₁₁H₁₆AsN₃O₄ *m*-Arsanilic acid, 4-(1-piperidyl)-, and salts, 2694⁸.
 C₁₁H₁₆BrO₂ 2-Camphanecarboxylic acid, 6-bromo-, 401⁸.
 C₁₁H₁₆ClO₂ 2-Camphanecarboxylic acid, 6-chloro-, 401⁴.
 C₁₁H₁₆ClO₃ 2 - Norcamphanecarboxylic acid, 6-chloro - 6 - (hydroxymethyl) - 5,5 - dimethyl-(?), 401⁵.
 —, 6 - (chloromethyl) - 6 - hydroxy-5,5-dimethyl-(?), 401⁵.

- C₁₁H₁₇IN₂** *p*-Toluidine, *N,N*-dimethyl- α -methylimino-, methiodide, 408⁴.
- C₁₁H₁₇IN₂O₂** Trimethyl (*p*-nitrophenethyl)ammonium iodide, 1250⁴.
- C₁₁H₁₇N** Aniline, *p*-(β -methylbutyl)-, 1801⁴.
—, *p*-(α -methylisobutyl)-, 1804³.
Benzylamine, α -*tert*-butyl-, and *HCl*, 3340⁴.
—, *N,N*-diethyl-, 73⁷.
Phenethylamine, β -isopropyl-, -*HCl*, 1640⁴.
—, *N,N,p*-trimethyl-, 2669⁴.
- C₁₁H₁₇NO** Benzyl alcohol, α -(α -aminobutyl), 908⁴.
—, α -(α -aminoisobutyl)-, 908⁴.
2-Bornylencarboxamide, 1809².
2-Camphanenitrile, hydroxy-, 401⁴, and -*HCl*, 1809^{1,3}.
5-Cararanitrile, 5-hydroxy-, 3192³.
Naphthonitrile, decahydrohydroxy-, 1113³.
Phenethylamine, *p*-methoxy *N,N*-dimethyl-, 2669⁴.
Propylamine, γ -methoxy Δ -methyl- γ -phenyl-, and -*HCl*, 1803³.
- C₁₁H₁₇NO₂** Ephedrine, *p*-methoxy, and -*HCl*, 1255⁴.
Guaiacol, (γ -aminobutyl)-, and -*HCl*, 1449⁷.
Spiro[piperidine - 1,1'-pyrrolidine]-3'-carboxylic acid, *N*-hydroxy-5'-methylene-, betaine, 1813¹.
- C₁₁H₁₇NO₂S** α -Toluenesulfonamide, *N,N*-diethyl-, 99⁴, 2254⁷.
- C₁₁H₁₇NO₄** 2-Camphancarboxylic acid, 6-keto-, oxime, 402¹.
Ephedrine, 4-hydroxy 3-methoxy-, 1255⁴.
Indolic acid, 3,1,5,6,7,7₁ hexahydro-, Et ester, 245⁴.
Phenethylamine, β ,3,4-trimethoxy-, 1462³.
- C₁₁H₁₇NO₄** 1,3-Cyclohexanedicarboxylic acid, 4,5-diketo-2,2,3-trimethyl-, Me ester, 5-oxime, 1259⁴.
2,4-Quinolinedicarboxylic acid, decahydro-, and salts, 1815².
- C₁₁H₁₇NO₅** 3-Indolepropionic acid, octahydro-3,3a-dihydroxy 2-keto-, 3054⁷.
1-Pyrrolidineacetic acid, 2-carboxy-5-keto-, di-Et ester, 3044⁴.
- C₁₁H₁₇NO₅S** Valeric acid, α -sulfo-, PhNH₂ salt, 3600⁴.
- C₁₁H₁₇N₂O** Cyclopentanone, 2-cyclopentylidene-, semicarbazone, 1103².
- C₁₁H₁₇OP** Phosphine oxide, ethylphenylpropyl-, 60².
- C₁₁H₁₈** Camphene, 1-methyl-, 1809⁴.
Tricyclene, 2-methyl-, 1809³.
- C₁₁H₁₈BrN** Trimethyl(*p*-methylbenzyl)ammonium bromide, 412⁴.
- C₁₁H₁₈BrNO₂** Spiro[piperidine - 1,1'-pyrrolidine]-3'-carboxylic acid, *N*-bromo-5'-methylene-, 1813¹.
- C₁₁H₁₈ClNO** 2-Camphancarboxamide, 6-chloro-, 401⁴.
Ethylhydroxyphenylpropylammonium chloride, 63⁷.
- C₁₁H₁₈ClN₂O** Epicamphor, 5-chloro-, semicarbazone, 1109⁴.
- C₁₁H₁₈HgO₂** Santene, hydroxymercuri acetate, 237⁴.
- C₁₁H₁₈INO₂** (3,4-Dihydroxyphenethyl)trimethylammonium iodide, 2669⁴.
- C₁₁H₁₈N₂** 2-Camphanenitrile, 2-amino-, and -*HCl*, 1808⁴.
2-Fenchanenitrile, 2-amino-, 1808⁴.
Hydrazine, (*p*- β -methylbutylphenyl)-, 1801⁴, 1802¹.
- C₁₁H₁₈N₂O** 1-Norcamphancarboxylic acid, 3,3-dimethyl-2-methylene-, hydrazide, and *HCl*, 401⁴.
- C₁₁H₁₈N₂O₂** 2,5-Pyrrolopyrazine-1,4-dione, 2,3,6,7,8,8a-hexahydro-3-isobutyl-, 390⁴.
- C₁₁H₁₈N₂O₃** Barbituric acid, ethylisoamyl-, 2937¹, *Na* salt, 1489⁴.
5-Pyrazolecarboxylic acid, 4-hydroxy-3-isoamyl-, Et ester, 3903⁴.
- C₁₁H₁₈N₂O₄** Cyclohexanecarboxylic acid, 4,5-diketo-2,2,3-trimethyl-, Me ester, dioxime, 1259².
Glutamic acid, *N*-(cyanomethyl)-, di-Et ester, 3014⁴.
1,2-Pyridazinedicarboxylic acid, 3,6-dihydro-4-methyl-, di-Et ester, 1123⁴.
- C₁₁H₁₈N₂O₅** Glycine, *N*-(α -carboxycyclohexyl)-*N*-nitroso-, 215⁷.
- C₁₁H₁₈O** Cyclopentanone, 2-ethyl 2-isopropenyl-5-methyl-, 1103⁴.
Isopulegone, 2-methyl-, 1103⁴.
2-Pentanone, 3- Δ^1 -cyclohexenyl-, 3187⁴.
- C₁₁H₁₈O** $\Delta^1\alpha$ -Cyclopentanecetic acid, α -ethyl-, Et ester, 3187⁴.
 Δ^1 -Cyclopentanecetic acid, α -butyl-, 901⁴.
2-Menthencarboxylic acid, 1809¹.
2-Norcamphancarboxylic acid, 5,5,6-trimethyl-, 101⁴.
- C₁₁H₁₈O** 2-Camphancarboxylic acid, 6-hydroxy-, 101².
Cyclopentanepropionic acid, β,β ,5-trimethyl-, 1103⁴.
- C₁₁H₁₈O₂** Camphoric acid, mono-Me ester, 577⁴.
Caronic acid, di-Et ester, 1249⁷.
Cyclohexanecetic acid, 2-carboxy-, di-Me ester, 587¹.
Cyclohexanol, methyl-, acid succinate, 374⁴.
1,2-Cyclopentanedicarboxylic acid, 2,3,3,4-tetramethyl-, 401².
Malonic acid, isopropenylmethyl-, di-Et ester, 227⁴.
Valeric acid, β -acetyl- α -ethyl- γ -keto-, Et ester, 2250⁴.
- C₁₁H₁₈O₂S** 3-Camphorsulfonic acid, Me ester, 1626³.
- C₁₁H₁₈O₃** Succinic acid, α -acetyl- β -methyl-, di-Et ester, 385⁴.
- C₁₁H₁₈N** Pyrrole, 1-isoamyl-2,5-dimethyl-, 243⁴.
- C₁₁H₁₈NO** Formimidic acid, bornyl ester, -*HCl*, 387⁴.
- 3-Menthanenitrile, 3-hydroxy-, 1809¹.
2-Menthencarboxamide, 1809².
2-Naphthamide, decahydro-, 909⁴.
 Δ^2 -2-Pentenone, 4-methyl-3-(1-piperidyl)-, 3905⁴.
- C₁₁H₁₈NO₂** 2-Camphancarboxamide, 6-hydroxy-, 401⁴.
- C₁₁H₁₈NO₄** Glycine, *N*-(α -carboxycyclohexyl)-, di-Me ester, 1971⁴, and -*HCl*, 245^{4,8}.
- C₁₁H₁₈NO₅S** Butylsulfuric acid, *o*-toluidine salt, 53⁷.
Isoamylsulfuric acid, PhNH₂ salt, 53².
Propylsulfuric acid, *N,N*-dimethylaniline salt, 53².
- C₁₁H₁₈N₂O** 2-Butanone, 1- Δ^1 -cyclohexenyl-, semicarbazone, 3186⁴.
Cyclopentanone, 2-ethyl-2-isopropenyl-, semicarbazone, 1103².
Epicamphor, semicarbazone, 1109⁴.
- C₁₁H₁₈N₂O₄** 1,3,5,2-Oxiazine-2-acetic acid, 2-ethyltetrahydro-4-keto-3,5-dimethyl-6-methylimino-, Me ester, 2132¹.

- C₁₁H₂₀** Cyclohexane, 2-ethyl-1,1-dimethyl-3-methylene-, 738¹.
 —, 1,1,2,2-tetramethyl-3-methylene-, 738¹.
 2,6-Nonadiene, 2,6-dimethyl-, 50².
 2,6-Octadiene, 2,3,7-trimethyl-, 50².
C₁₁H₂₀ClN Campholimidyl chloride, *N*-methyl-, 2875².
C₁₁H₂₀N₂ Camphor, 6-methyl-, hydrazone, 1809².
 3-Menthanenitrile, 3-amino-, and -HCl, 1808², 1809².
C₁₁H₂₀N₂O₃ Leucine, *N*-prolyl-, 390².
 Proline, 1-leucyl-, 390².
OH₂N₂O₃V Piperidine ammonium vanadyl-malonate, 2230².
C₁₁H₂₀O Homofenchyl alcohol, 1809².
C₁₁H₂₀O₂ η -Decenic acid, Me ester, 3350¹.
 Hydrosorbic acid, β -propyl-, Et ester, 3187⁷.
 Menthol, formate, 400⁶.
C₁₁H₂₀O₃ Pelargonic acid, δ -keto- γ , η -dimethyl-, 578².
 Undecylic acid, keto-, 894⁶, 3348².
C₁₁H₂₀O₄ Azelaic acid, dimethyl ester, 1216².
 1,4-Heptanediol, diacetate, 3053².
C₁₁H₂₀O₁₀ Arabinose, *d*-galacto-*d*-, 393², 2880².
 Primeverose, 2879².
C₁₁H₂₁Br 1-Hendecene, 11-bromo-, 894², 895².
C₁₁H₂₁BrO₂ Capric acid, α -bromo-, Me ester, 894².
 Undecylic acid, α -bromo-, 3182².
C₁₁H₂₁N Cyclohexylamine, *N*-isoamylidene-, 2876².
 Quinoline, decahydrodimethyl-, 2696².
C₁₁H₂₁NO Campholamide, *N*-methyl-, 2875².
 Formamide, *N*-methyl-, 792², 4², 5², 7².
C₁₁H₂₁NO₂ Alanine, *N*-cyclohexyl-, Et ester, and -HCl, 2876².
 Butyric acid, β -(isoamylimino)-, Et ester, 2876².
 Cyclopentaneacetic acid, α -dimethylamino-, Et ester, 59².
 Menthol, carbamate, 1806².
 1-Piperidineethanol, β -(γ , δ -epoxybutyl)-, 59².
C₁₁H₂₁NO₂ Undecylic acid, ϵ -keto-, oxime, 3348².
C₁₁H₂₁N₂O Menthone semicarbazone, 400⁶.
 Semicarbazide, 4-*d*-bonyl-, and -HCl, 3613¹.
C₁₁H₂₁N₂O₂ Enanthic acid, δ -acetyl- α -methyl-, semicarbazone, 1103².
C₁₁H₂₁BrN Spiro[2 - piperidine - 1,1' - piperidine], 1-bromo-, 96².
C₁₁H₂₁BrN₂O Capraldehyde, α -bromo-, semicarbazone, 894².
C₁₁H₂₁Br₂ Hendecane, 1,10-dibromo-, 894².
C₁₁H₂₁ClNO Hendecane, 2-chloro-2-nitroso-, 2872².
C₁₁H₂₁ClNO₂ Hendecane, 2-chloro-2-nitro-, 2873².
C₁₁H₂₁N₂O Urea, menthyl-, 794², 7², 8².
C₁₁H₂₁N₂O₂ Malonamide, *N*, *N'*-diethoxy-, α , α -diethyl-, 2249².
C₁₁H₂₁O Δ^2 -1-Hendecenol, 894².
 Octanol, cyclopropyl-, 2666².
C₁₁H₂₁O₂ Formic acid, decyl ester, 2658².
 2-Hendecanone, 11-hydroxy-, 894².
 2-Pentanone, 4-isoamoxy-4-methyl-, 892².
 Undecylic acid, 2873².
C₁₁H₂₁O₃ Acetic acid, methoxy-, α -methylheptyl ester, 1095².
 Capric acid, ϵ -hydroxy-, Me ester, 894².
 Carbonic acid, isoamyl ester, 1729².
C₁₁H₂₁O₄ Fructoside, tetramethyl- β -methyl-, 2665².
 Galactose, pentamethyl-, 3891².
 Glucoside, methyltetramethyl-, 63², 3891².
 Mannose, pentamethyl-, 3891².
C₁₁H₂₁BrO 1-Hendecanol, 10-bromo-, 894².
C₁₁H₂₁BrO₂ Enanthaldehyde, α -bromo-, di-Et acetal, 3608².
C₁₁H₂₁NO 2-Heptanone, 3-butyl-, oxime, 3347².
C₁₁H₂₁N₂O Alanine, *N*, *N*-dipropyl-, Et ester, 60².
 Butyric acid, β -isoamylamino-, ethyl ester, and -HCl, 2876².
 Undecylic acid, amino-, 258².
C₁₁H₂₁N₂O Octanone, dimethyl-, semicarbazone, 1796².
C₁₁H₂₁N₂O₂ 2-Pentanone, 4-butoxy-4-methyl-, semicarbazone, 892².
 —, 4-isobutoxy-4-methyl-, semicarbazone, 892².
C₁₁H₂₁N₂ 2-Pipecoline, 1-(ϵ -aminoamyl)-, 96².
C₁₁H₂₁N₂O Isocaproamide, *N*-ethyl- α -propyl-amino-, and -HCl, 1657².
 Propionamide, *N* - isoamyl - α - propyl-amino-, and -HCl, 1657².
C₁₁H₂₁O Ether, decyl methyl, 2658².
 —, heptyl isobutyl, 3608².
C₁₁H₂₁O₂ Enanthaldehyde, di-Et acetal, 3608².
 1,10-Hendecanediol, 894².
C₁₁H₂₁O₂Pb Triethyllead isovalerate, 1445².
 Triethyllead valerate, 1445².
C₁₁H₂₁O₂B Arabinose, di-Pr mercaptal, 64².
 Heptane, 4,4-bis(ethylsulfonyl)-, 2884².
 Hexane, 3,3-bis(ethylsulfonyl)-2-methyl-, 2884².
C₁₁H₂₁S₂ Heptane, 4,4-bis(ethylmercapto)-, 2884².
C₁₁H₂₁N Hexylamine, β -butyl- α -methyl-, and chloroplatinate, 3347².
C₁₁H₂₁N₂ Guanidine, pentaethyl-, 2878².
C₁₂Co₂Fe₂N₁₂ Iron cobalticyanide, 1769².
C₁₂Cr₂Fe₂N₁₂ Iron chromicyanide, 1769².
C₁₂Cr₂Fe₂, 2642².
C₁₂Eu₂N₁₂Pt + 21H₂O Europium cyanoplatinite, 1602².
C₁₂Fe₂N₁₂NaOS₂, 866².
C₁₂Fe₂Mn₂N₁₂ Iron manganicyanide, 1769².
C₁₂Fe₂N₁₂ Iron ferricyanide, 1769².
C₁₂H₂Fe₂K₂N₁₂O₂ Violet salt of Williamson, 1770¹.
C₁₂H₂Cl₂N₂O₂ Naphthalic anhydride, chlorodinitro-, 2683².
C₁₂H₂Cl₂N₂O₄ 2,1,3-Benzotriazole-4,5-dione, 6,7-dichloro-2-(*p*-nitrophenyl)-, 2689².
C₁₂H₂Cl₂N₂S Thiadiazolo[3- α]phenazine, 4,5-dichloro-, 2690².
C₁₂H₂Cl₂O₂P Phosphorus oxychloride, bis(trichlorophenoxy)-, 3056².
C₁₂H₂ClN₂ *peri*-Quinazoquinazoline, 4-chloro-, 3052².
C₁₂H₂ClO₂ Acenaphthenequinone, 3-chloro-, 2683².
C₁₂H₂ClO₂ Naphthalic anhydride, 4-chloro-, 2683².
C₁₂H₂Cl₂N₂O₂ 2,1,3-Benzotriazol-5-ol, 4,6,7-trichloro-2-(*p*-nitrophenyl)-, 2689².
C₁₂H₂Cl₂N Carbazole, 1,3,6,8-tetrachloro-, 1982².
C₁₂H₂Cl₂N₂O₂ 2,1,3-Benzotriazol-5(4)-one, 4,4,6,7,7-pentachloro-6,7-dihydro-2-(*p*-nitrophenyl)-, 2689².
C₁₂H₂Cl₂O₂P Phosphoric acid, bis(trichlorophenyl) ester, *salts*, 2461².
C₁₂H₂I₂N₂ Triazene, 1,3-bis(3,4,5-triiodophenyl)-, 60².
C₁₂H₂N₂O₂ Dibenzofuran, trinitro-, 1982².

- C₁₂H₈N₂O₂** Carbazole, tetranitro-, 1982¹.
C₁₂H₈N₂O₁₁ Ether, 2,4-dinitrophenyl picryl, 740³.
C₁₂H₈BrNO₂ 3-Pyranoquinolone, 2-bromo-, and salts, 382².
C₁₂H₈BrN₂O₂ Biphenyl, 4-bromo-3,2',4'-trinitro-, 379⁵.
C₁₂H₈Br₂K₂N₂O₂ Phenol, 2,6-dibromo-4,4'-azobis-, di-K deriv., 1971¹⁸.
C₁₂H₈Br₂N₂O₂ Ether, bis(4-bromo-?-nitrophenyl), 2674¹.
 —, 2,4-dibromophenyl 2,4-dinitrophenyl, 2673³.
C₁₂H₈Br₂NO₂ Biphenyl, 3,4,4'-tribromo-2'-nitro(?), 379⁵.
C₁₂H₈Br₂N₂O₂ Azoxybenzene, tribromo - *p'*-nitro-, 3895⁵.
C₁₂H₈Br₂S₂ Trisulfide, bis(2,5-dibromophenyl), 2885⁵.
C₁₂H₈ClNO₂ Naphthalimide, 4-chloro-, 2683³.
C₁₂H₈Cl₂N₂O₂ Biphenyl, dichlorodinitro-, 2800⁷.
C₁₂H₈Cl₂N₂O₂ Ether, bis(4-chloro-2-nitrophenyl), 2674¹.
C₁₂H₈Cl₂N₂O₂S₂ Phenol, 3,3'-dithiobis[6-chloro-4-nitro-, 2692³.
C₁₂H₈Cl₂O₂ Naphthalyl chloride, 2682⁷.
C₁₂H₈Cl₂ Biphenyl, 2,4,2',4'-tetrachloro-, 3181⁵.
C₁₂H₈Cl₃S₂ Trisulfide, bis(2,5-dichlorophenyl), 2885⁵.
C₁₂H₈HgO₂ Furan, 2-ethynyl-, mercury deriv., 2896⁴.
C₁₂H₈I₂N₂O₂ Biphenyl, 4,4'-diiodo-2,2'(and 2,3')-dinitro-, 80⁶.
C₁₂H₈K₂O₂Br₂ + 4.5H₂O, 3322¹.
C₁₂H₈N₂O₂Te Phenoxetellurine, dinitro-, 1251⁸, 1252¹.
C₁₂H₈N₂O₂ 4-Dibenzofuranol, 3,5-dinitro(?), 2130³.
C₁₂H₈N₄ *peri*-Quinazozoquinazoline, 3052².
C₁₂H₈N₄O₁₀ *o,o'*-Biphenol, 4,6,4',6'-tetranitro-, 1982¹.
C₁₂H₈N₄O₁₁Te Phenoxetellurine, 2,8-dinitro-, 10,10-dinitrate, 1104⁴.
C₁₂H₈O₂ Naphthalic anhydride, 3-hydroxy-, 2683³.
 1,2 - β - Naphthofurandione, 5-hydroxy-, 1645⁵.
C₁₂H₈Ag₂Cl₂N₂O₂S Benzenesulfenilide, 4-chloro - 2',4' - dihydroxy - 2 - nitro-, di-Ag deriv., 1971¹⁸.
C₁₂H₈AsCl₃N Phenarsazine, 1,3,9-trichloro-1,6-dihydro-, 98².
C₁₂H₈BrN₂O₂ Phenol, 2-bromo-6-nitro-4-(*p*-nitrophenyl)-, 2680⁴.
C₁₂H₈Br₂NO₂ Biphenyl, 4,4'-dibromo-3-nitro-, 379⁵.
 — Indophenol, dibromo-, 2720³, 3149⁴.
C₁₂H₈Br₂NO₂S₂ Disulfide, 2,5-dibromophenyl *o*-nitrophenyl, 2885⁷.
C₁₂H₈Br₂NO₂ Ether, *p*-bromophenyl 4-bromo-7-nitrophenyl, 2674¹.
 • Phenol, 2-bromo-4-(*p*-bromophenyl)-6-nitro-, 2680⁴.
 —, 2,6-dibromo-4-(*p*-nitrophenyl)-, 1109⁴.
C₁₂H₈Br₂O Phenol, 2,6-dibromo-4-(*p*-bromophenyl)-, 2680⁴.
C₁₂H₈Cl₂N₂O₂S Quinonimine, *N*-(4-chloro-2-nitrophenylmercapto)-, 905².
C₁₂H₈Cl₂N₂O₂S Benzenesulfenamide, 4-chloro-*N*-(2-hydroxy-4-keto-*p*-phenylidene)-2-nitro-, 1971¹⁸.
C₁₂H₈Cl₂N *peri*-Quinazozoquinazoline, 4-chloro-3,6-dihydro-, -HCl, 3052².
C₁₂H₈Cl₂NO₂ Biphenyl, 4,4'-dichloro-2-nitro-, 379⁵.
C₁₂H₈Cl₂NO₂S₂ Disulfide, 2,5-dichlorophenyl *o*-nitrophenyl, 2885⁷.
C₁₂H₈Cl₂NO₂ Ether, *p*-chlorophenyl 4-chloro-2-nitrophenyl, 2674¹.
C₁₂H₈Cl₂ Biphenyl, trichloro-, 1982².
C₁₂H₈I₂NO₂ Biphenyl, 4,4'-diiodo-2-nitro-, 80⁶.
C₁₂H₈K₂N₂O₂ Phenol, *l*-nitro-4,4'-azoxybis-, di-K deriv., 1972³.
C₁₂H₈NO₂ Isoquinoline, C₆O₂ addn. compd., 735⁵.
 1-Naphthoic acid, 8 cyano-, 2682².
C₁₂H₈NO₂ 2 - Furo[3,2-*f*]quinolinecarboxylic acid, 382².
C₁₂H₈NO₂Te Phenoxetellurine, nitro-, 1251⁸.
C₁₂H₈N₂O₂S 2,1,3 - Benzotriazole - 4 - sulfonic acid, 6,7 - dihydro - 6,7 - diket-2-phenyl-, K salt, 3904⁴.
C₁₂H₈N₂O₂ Biphenyl, trinitro-, 1981⁹.
C₁₂H₈N₂O₂ Furan, 2-(2,4,6-trinitrostyryl)-, 2895⁵.
C₁₂H₈N₂O₂Te + H₂O Phenoxetellurine, 2,6-dinitro-, 10-hydroxide 10-nitrate, 1104⁴.
 —, 2-nitro-, 10,10-dinitrate, 1104⁴.
C₁₂H₈Ag₂N₂O₂ 2,4(1,3) - Pyrimido[4,5-*b*]quinolinedione, 9-methoxy-, Ag deriv., 377³.
C₁₂H₈AsCl₃N Phenarsazine, 1,3(and 1,4)-dichloro-1,6-dihydro-, 98².
C₁₂H₈Br₂F₂N₂ *p,p'* - Bi[benzenediazonium fluoborate], 2668⁵.
C₁₂H₈Ba₂N₂O₂ Hydroxylamine, nitrophenyl-nitroso-, barium deriv., 3048⁹.
C₁₂H₈BrCl Biphenyl, 3-bromo-5-chloro-, 2680⁴.
C₁₂H₈BrNO₂ Biphenyl, bromonitro-, 1260¹, 2680⁵.
C₁₂H₈BrNO₂ Ether, *p*-bromophenyl *p*-nitrophenyl, 2673³.
 Phenol, 2-bromonitrophenyl-, 2680⁴.
C₁₂H₈BrN₂O₂ Azoxybenzene, bromonitro-, 3805⁷.
C₁₂H₈BrN₂O₂ Diphenylamine, 2'(3' and 4')-bromo-2,4-dinitro-, 405¹.
 Xenylamine, 4'-bromo-2,2'-dinitro-, 379⁷.
C₁₂H₈Br₂ Biphenyl, 2,5-dibromo-, 1259⁹.
C₁₂H₈Br₂ClN Xenylamine, 2,4'-dibromo-6-chloro-, 2680⁷.
C₁₂H₈Br₂N₂O₂ Phenol, 2,6-dibromo-4,4'-azobis-, and -HCl, 1971¹⁸.
 • Xenylamine, 2,4' - dibromo-6-nitro-, 2680⁴.
C₁₂H₈Br₂O Phenol, 2-bromo-4-(*p*-bromophenyl)-, 2680⁴.
 —, 2,6-dibromo-4-phenyl-, 2680⁴.
C₁₂H₈Cl₂NO₂ Biphenyl, *p*-chloro-*p'*-nitro-, 578⁹.
C₁₂H₈Cl₂NO₂S₂ Disulfide, *p*-chlorophenyl-sulfonyl *o*-nitrophenyl, 2885⁵.
C₁₂H₈Cl₂N₂O₂ Diphenylamine, 2'(3' and 4')-chloro-2,4-dinitro-, 404⁹, 405¹.
 Xenylamine, 4'-chloro-2,2'-dinitro-, 379⁷.
C₁₂H₈Cl₂O₂P Phosphorus monochloride, dipyrrocatechyl-, 2461¹, 3057¹.
C₁₂H₈Cl₂ Biphenyl, dichloro-, 1259⁹, 3181⁵.
C₁₂H₈Cl₂O₂ 2-Naphthaleneacetyl chloride, 1-chloro- α -mercapto-, P 3371¹.
C₁₂H₈Cl₂O₂S 3-Acenaphthenesulfonyl chloride, 4-chloro(?), 2683¹.
C₁₂H₈CoN₂O₂ Hydroxylamine, nitrophenyl-nitroso-cobalt deriv., 3049¹.
C₁₂H₈CuN₂O₂ Hydroxylamine, nitrophenyl-nitroso-, copper deriv., 3048⁹.
C₁₂H₈F₂ Biphenyl, *p,p'*-difluoro-, 2668⁵.
C₁₂H₈I₂NO₂ Biphenyl, *p*-iodo-*p'*-nitro-, 578⁹.

- C₁₂H₈IN₂O₄ Diphenylamine, 3'(and 4')-iodo-2,4-dinitro-, 4051.
- C₁₂H₈I₂NO₄ 3-Indolepropionic acid, 2-carboxy-4,5,6-triiodo-, 907.
- C₁₂H₈K₂N₂O₃ Phenol, *p,p'*-azoxybis-, di-K deriv., 1972².
- C₁₂H₈N₂ Phenanthroline, 868⁵.
Phenazine, 1815⁴.
- C₁₂H₈N₂Na₂O₃ Phenol, *p,p'*-azoxybis-, di-Na deriv., 1972².
- C₁₂H₈N₂O 2-Phenazolin, 1815⁴.
- C₁₂H₈N₂O₃ Ketone, *p*-nitrophenyl pyridyl, and salts, 93⁹, 94^{2,3}.
- C₁₂H₈N₂O₄ Biphenyl, 3,4'-dinitro-, 2681¹.
- C₁₂H₈N₂O₅ Furan, 2-(2,4-dinitrostyryl)-, 2895⁸.
Phenol, 2-nitro-4-(*p*-nitrophenyl)-, 1109⁸.
- C₁₂H₈N₂O₇Te Phenoxetellurine, 10,10-dinitrate, 1104⁴.
—, 4-nitro-, 10-hydroxide 10-nitrate, 1104⁵.
- C₁₂H₈N₂Na₂O₃ 2,4(1,3) - Pyrimido[4,5- β]quinolinedione, 9-methoxy-, Na deriv., 377².
- C₁₂H₈N₂NaO₄ Phenol, 2 nitro-4,4'-azobis-, Na deriv., 1971⁹.
- C₁₂H₈N₄ *peri* - Quinazolinazoline, 1,8-dihydro-, and *di-HCl*, 3052⁸.
- C₁₂H₈N₄O₆ Diphenylamine, 2,4,3'(and 2,4,4')-trinitro-, 404⁹.
- C₁₂H₈N₄O₇ Acetamide, *N*-(1,6,8 trinitro-2-naphthyl)-, 404⁸.
- C₁₂H₈N₄NiO₈ Hydroxylamine, nitrophenyl-nitroso-, nickel deriv., 3048⁹.
- C₁₂H₈N₄O₇ *p*-Quinonediazide, picrate, 1105⁸.
- C₁₂H₈O Dibenzofuran, 2130⁴.
- C₁₂H₈O₂ 4-Dibenzofuranol, 2130².
- C₁₂H₈O₃ 4,5-Dibenzofurandiol, 2130².
- C₁₂H₈O₃Te Phenoxetellurine, 10,10-dioxide, 1104⁸.
- C₁₂H₈O₄ 1,4-Pyran - 2 - carboxylic acid, 4-keto-6-phenyl-, 2901⁹.
Quinone, 2-(2,1 - dihydroxyphenyl)-, 2887¹.
- C₁₂H₈O₅ 1,4-Naphthoquinone, 5,6-dihydroxy, monoacetate, 3053¹.
- C₁₂H₈O₅S₂ 1-Phenol - 4 - sulfonic acid, bimol cyclic sulfonide, 3605¹.
- C₁₂H₈O₅P₂ *o*-Phenylene pyrophosphate, 3056⁹.
- C₁₂H₈AsClN Phenarsazine, 1-chloro-1,6-dihydro-, 98³, 1252³.
- C₁₂H₈As₂N₂O Phenarsazinic acid, 5 nitro-*Ba* salt, 98⁴.
- C₁₂H₈As₂NO₃ Benzoic acid, *o*-(6 hydroxy-3-pyridylarseno)-, P 2907⁸.
- C₁₂H₈BrClN Xenylamine, bromochloro-, 2680^{6,7}.
- C₁₂H₈BrN₂O Harmol, bromo-, and salts, 1650⁶.
- C₁₂H₈BrN₂O₂ Diphenylamine, *p'*-bromo-*o*-nitro-, 3199¹.
Xenylamine, bromonitro-, 379⁶, 2680^{6,9}.
- C₁₂H₈BrN₂O₃ 3 Pyraquinoline, 2-bromo-7,8,9,10 - tetrahydro - 7 - nitroso-, 382⁶.
- C₁₂H₈BrO Phenol, bromophenyl-, 2680^{4,5}.
- C₁₂H₈BrO₄ 2-Indancarboxylic acid, 2-bromo-1,3-diketo-, Et ester, 52¹.
- C₁₂H₈Br₂N *o*-Biphenylamine, 3,5-dibromo-, 1259².
- C₁₂H₈Br₂O₃P Phosphoric acid, bis(*p* bromophenyl) ester, and salts, 2461^{1,2}.
- C₁₂H₈Cl Acenaphthene, 3 chloro-, 2682².
- C₁₂H₈ClN₂O₂ Xenylamine, 4'-chloro 2 nitro-, 2680⁹.
- C₁₂H₈ClN₂O₃S Phenol, *p*-(4-chloro-2-nitrophenyl)mercaptaminol-, 905⁸.
- C₁₂H₈ClN₂O₃S Benzenesulfenamide, 4-chloro-2',4'-dihydroxy-2-nitro-, 1971⁴.
- C₁₂H₈ClO 3-Acenaphthol, 4-chloro-, 2683³.
- C₁₂H₈ClO₂ Acetic acid, chloro-, 2-naphthyl ester, 1256⁹.
1-Naphthoyl chloride, 5-methoxy-, 909⁷.
- C₁₂H₈ClO₃ 1,4-Naphthoquinone, 2-chloro-3-ethoxy-, 84¹.
- C₁₂H₈ClO₃S 3-Acenaphthensulfonic acid, 4-chloro-(?), 2683¹.
- C₁₂H₈Cl₂N *o*-Biphenylamine, 3,5-dichloro-, and -HCl, 1259⁸.
Diphenylamine, *p,p'*-dichloro-, 98³.
- C₁₂H₈Cl₂NS Benzenesulfenamide, 2,5-dichloro-, 3355⁴.
- C₁₂H₈Cl₂O₃P Phosphoric acid, bis(chlorophenyl) ester, and salts, 2460⁹, 2461^{1,2}.
- C₁₂H₈Cl₂NO₃ 1,3-Benzodioxan, 6-acetamido-2,4-bis(trichloromethyl)-, 233⁸.
- C₁₂H₈F₂N₂O₃S Benzenesulfonyl fluoride, *m,m'*-aziminobis-, 3604².
- C₁₂H₈IO₂ Acetic acid, iodo-2-naphthoxy-, 1678⁷.
- C₁₂H₈KN₂O₃ Azoxybenzene, *p*-nitrosohydroxylamine, potassium deriv., 3048^{4,5}.
- C₁₂H₈N See Carbazole.
- C₁₂H₈NO Furo[3,2- β]quinoline, 7-methyl-, and salts, 382^{8,9}.
 β -Naphthoxazole, 2-methyl-, and -HCl, 3364¹.
- C₁₂H₈NOTE Phenoxetellurine, 2 amino-, 1252¹.
- C₁₂H₈NO₂ Indophenol, P 21367, 3149⁸.
- C₁₂H₈NO₃ Furan, 2 (β -nitrostyryl)-, 2895⁸.
1,2 - Naphthoquinone, 4-acetamido-, 1988¹.
Phenol, *p*-(*p*-nitrophenyl)-, 579¹, 1109⁸.
5 Quinolineacrylic acid, 6 hydroxy-, and salts, 3197^{6,7}.
- C₁₂H₈NO₄ Acridinic acid, mono-Me ester, 2697².
Furancarboxylic acid, phenylcarbamyl-, 2890².
- C₁₂H₈NS Phenothiazine, 3017⁷.
- C₁₂H₈N₂O₃ Azoxybenzene, *p*-nitro-, 3895⁴.
Ketone, *p*-nitrophenyl 4-pyridyl, oxime, 94³.
Phenol, *p*-(*p*-nitrophenylazo)-, 1103³, 1251¹.
2,4(1,3) - Pyrimido[4,5- β]quinoline-dione, 9-methoxy-, 377².
- C₁₂H₈N₂O₄ *o*-Biphenylamine, 3,4'(or 5,4')-dinitro-, 1260¹.
Hydroquinone, 2 - (*p* - nitrophenylazo)-, 1251¹.
Phenol, 2-nitro-4,4'-azobis-, and -HCl, 1971⁹.
Pyrocatechol, 4 - (*p* - nitrophenylazo)-, 1251¹.
Resorcinol, 4-(nitrophenylazo)-, 1103³, 1251¹.
Xenylamine, 2,4'-dinitro-, 2681¹.
- C₁₂H₈N₂O₅ Phenol, 2-nitro-4,4'-azoxybis-, 1972².
Phloroglucinol, 2 - (*p* - nitrophenylazo)-, 1801⁸.
Pyrogallol, 4 (*p*-nitrophenylazo)-, 1801⁸.
- C₁₂H₈N₂O₇ Ether, ethyl 1,0,8-trinitro-2-naphthyl-, 83³, 404¹.
- C₁₂H₈N₂S See Thionine.
- C₁₂H₈N₂O₂ 2,1,3 - Benzotriazole, 5-amino-4-nitro 2-phenyl-, 2689⁴.
- C₁₂H₈N₂O₄ Triazene, 1,3-bis(*p*-nitrophenyl)-, 2671⁹.
- C₁₂H₈N₂S Benzothiadiazole, 4-amino-3-phenylazo-, 2690⁹.
- C₁₂H₈ See Acenaphthene; Biphenyl.
- C₁₂H₈AsClN Phenarsazine, 2-amino-1-chloro-1,6-dihydro-, -HCl, 98³.
- C₁₂H₈As₂N₂Na₂O₃ See Sodium arspenamine.

- $C_{12}H_{10}BrN$ *o*-Biphenylamine, 5-bromo-, and -HBr, 1259^o.
Xenylamine, 2-bromo-, 1109^o.
 $C_{12}H_{10}BrNO_2$ Naphthazoledione, bromotetrahydro-, 1123^o.
3-Pyranquinolone, 2-bromo - 7,8,9,10-tetrahydro-, and salts, 382^o.
 $C_{12}H_{10}BrNO_3$ Glyoxylohydroxamic acid, (*p*-bromophenyl)-, diacetate, 742^o.
 $C_{12}H_{10}BrP$ Phosphine, bromodiphenyl-, 66^o.
 $C_{12}H_{10}Br_2O_3S_2$ Propionic acid, β -(6,8-dibromo-3,4-dihydro - 4 - keto - 1,2 - benzothio-pyranylmercapto)-, 741^o.
 $C_{12}H_{10}Br_2N_2S$ β - Naphthothiazole, 2-methyl-amino-, hexabromide, 584^o.
 $C_{12}H_{10}ClNO$ Acetimidic acid, α -chloro-, 2-naphthyl ester, -HCl, 1256^o.
Aniline, *p*-(*p*-chlorophenoxy)-, 2674^o.
1-Naphthol, 4 - (β -chloro - α -iminoethyl)-, and -HCl, 1257^o.
 $C_{12}H_{10}ClNO_2S$ 3 - Acenaphthenesulfonamide, 4-chloro-(?), 2683^o.
 $C_{12}H_{10}ClN_2O_8b$ Benzenestibonic acid, *p* (3-chloro - 4 - hydroxyphenylazo)-, 71^o.
 $C_{12}H_{10}ClN_2O_2$ *o*-Phenylenediamine, *N*¹ (chloro phenyl)-4-nitro-, 269^o.
 $C_{12}H_{10}ClOP$ Phosphine oxide, chlorodiphenyl-, 66^o.
 $C_{12}H_{10}Cl_2CoN_2$ Addn. compd. of $CoCl_2$ and pyridine, 1235^o.
 $C_{12}H_{10}Cl_2N_2O_4$ Benzimidazole, dichloro-2-methyl-, diacetate, 2691^o.
 $C_{12}H_{10}Cl_2O_8S$ 1,3-Benzodioxan-6-sulfonic acid, 2,4-bis(trichloromethyl)-, Et ester, 3607^o.
 $C_{12}H_{10}CoN_2O_8S$ Addn. compd. of $CoSO_4$ and pyridine, 1235^o.
 $C_{12}H_{10}FeN_2O_4$, 2232^o.
 $C_{12}H_{10}Ge_2O_3$ Germanoformic anhydride, di-phenyl-, 3897^o.
 $C_{12}H_{10}INO$ Furo[3,2- ξ]quinoline, methiodide, 3827^o.
 $C_{12}H_{10}INO_3$ Cinchoninic acid, 1,2-dihydro 6-iodo-2-keto-, Et ester, 586^o.
 $C_{12}H_{10}INO_3$ 3-Indolepropionic acid, 2-carboxy-5-iodo-, 90^o.
 $C_{12}H_{10}I_2Sn$ Stannane, diiododiphenyl-, 1973^o.
 $C_{12}H_{10}K_4O_{16}V_2 + 6H_2O$ Potassium vanadylcitrate, 542^o.
 $C_{12}H_{10}K_4O_{16}V_2 + 6H_2O$ Potassium vanadium citrate, 1235^o.
 $C_{12}H_{10}N_2$ (See also 4 *benzene*)
Pyridine, 2 (and 3)-benzalamino, 1814^o.
 $C_{12}H_{10}N_2O$ Azoxybenzene, 1450^o.
Diphenylamine, nitroso-, 184^o.
Harmol, salts, 1656^o.
Ketone, *p*-aminophenyl 2 (and 4)-pyridyl, and salts, 941^o.
• Phenol, *p*-phenylazo-, 1103^o.
 $C_{12}H_{10}N_2OTe$ Phenoxtellurine, diamino-, 1252^o.
 $C_{12}H_{10}N_2O_2$ *o*-Biphenylamine, 4'-nitro-, 1260^o.
Hydroquinone, 2-phenylazo-, 1251^o.
1-Pyrazolecarboxylic acid, 5-(3-methyl-salicyl)-3-methyl-, lactone, 2471^o.
• Pyridine, 2-(*p*-nitrobenzyl)-, salts, 93^o.
Pyrocatechol, 4-phenylazo-, 1251^o.
Resorcinol, 4-phenylazo-, 1103^o.
 $C_{12}H_{10}N_2O_3$ Acetamide, *N*-(6-nitro-2-naphthyl)-, 2268^o.
Azobenzene, 2,4,4'-trihydroxy-, 68^o.
2-Furancarboxylic acid, 3-formyl-, phenyl-hydrazone, 2890^o.
Hydantoin, 5- β -(hydroxymethylene)phen-ethylidene], 2259^o.
2-Isoindolinebutyronitrile, β -hydroxy-1,3-diketo-, 62^o.
Phloroglucinol, 2-phenylazo- 1801^o.
Pyrogallol, 4-phenylazo-, 1801^o, 3050^o.
 $C_{12}H_{10}N_2O_3S$ Phenol, *p*-phenylsulfonylazo-, 68^o.
3-Thiophenecarboxanilide, 4,5-dihydro-4,5-diketo-2-methyl-, 5-oxime, 734^o.
 $C_{12}H_{10}N_2O_4$ Pyrogallol, 4-phenylazoxy-, 3050^o.
 $C_{12}H_{10}N_2O_3S$ Harmolsulfonic acid, 1656^o.
 $C_{12}H_{10}N_2O_3S$ 3-Indolepropionic acid, 2-carboxy-5-nitro-, 90^o.
 $C_{12}H_{10}N_2S$ β Naphthothiazole, 2-methylamino-, 584^o.
 $C_{12}H_{10}N_2O_8b$ Benzenestibonic acid, *p*-(4-hydroxy-3-nitrophenylazo)-, 71^o.
 $C_{12}H_{10}N_2O_3$ Azoxybenzene, *p*-nitrosohydroxylamine, 3048^o.
 $C_{12}H_{10}N_2O_4$ Benzidine, 2,3'-dinitro-, 1110^o.
 $C_{12}H_{10}N_2O_8S$ 2,1,3-Benzotriazole-4-sulfonic acid, 7-amino-6-hydroxy-2-phenyl-, 3004^o.
 $C_{12}H_{10}N_2O_8S_2$ Aniline, 2,2-dithiobis[5-nitro-, 2690^o.
 $C_{12}H_{10}N_2O_8$ 2 Naphthylamine, *N*, *N*-dimethyl-1,6,8 trinitro-, 404^o.
-, *N* ethyl-1,6,8-trinitro-, 404^o.
1,2,5 Triazole-3,4-dicarboxylic acid, 1-(*p*-nitrophenyl)-, di-Me ester, 2690^o.
 $C_{12}H_{10}N_2O_7$ Aniline, picrate, 3355^o.
 $C_{12}H_{10}N_2O_8$ Guaiacol, 3,4,6-trinitro-, pyridine salt, 377^o.
 $C_{12}H_{10}Na_2O_{16}V_2 + 12H_2O$ Sodium vanadylcitrate, 542^o.
 $C_{12}H_{10}Na_2O_{16}V_2 + 12H_2O$ Sodium vanadium citrate, 1235^o.
 $C_{12}H_{10}O$ Acetonaphthone, 404^o.
Phenol, *o* (and *p*)-phenyl-, 2130^o.
Phenyl ethers, 2516^o.
 $C_{12}H_{10}O_2$ Biphenol, 2130^o.
1 Naphthaldehyde, 5-methoxy-, 909^o.
2 Naphthoic acid, 4-methyl-, 582^o.
 $C_{12}H_{10}O_2S_2$ 1,9-Benzodi-1,4-thiopyran-4,6-dione, 2,3,7,8-tetrahydro-, 741^o.
 $C_{12}H_{10}O_3$ Acetic acid, naphthoxy-, 1678^o.
1,4-Naphthoquinone, 2-ethoxy-, 83^o.
 $C_{12}H_{10}O_3S$ Phenol, *p*-(phenylsulfonyl)-, 3605^o.
 $C_{12}H_{10}O_4$ (See also *Quinhydrone*)
Biphenyl, 2,4,2',5'-tetrahydroxy-, 2887^o.
Valeric acid, β benzoyl- γ -hydroxy- α -keto-, lactone, 3000^o.
 $C_{12}H_{10}O_4S$ Phenol, *p*, *p*'-sulfonylbis-, 3605^o.
 $C_{12}H_{10}O_8S_2Te$ + $3H_2O$ Phenoxtellurine, 10,10-dibisulfate, 1104^o.
 $C_{12}H_{10}O_{12}$ Oxalic acid, cyclic glyceryl ester, 3358^o.
 $C_{12}H_{11}AsN_2O_3$ Phenazarsinic acid, 5-amino-, di-HCl, 98^o.
 $C_{12}H_{11}Bi$ Bismuthine, diphenyl-, 1449^o.
 $C_{12}H_{11}BrN_2O$ Harmolol, bromo-, and salts, 1656^o.
 $C_{12}H_{11}BrN_2OS$ 3(2)-Thiopyran[4,3]pyrazolone, 2-(*p*-bromophenyl)-3a,4,6,7-tetrahydro-, 1262^o.
 $C_{12}H_{11}BrO_2$ Δ^5 2,4-Hexenedione, 6-bromo-6-phenyl-, 2901^o.
 $C_{12}H_{11}CeO_3$, 867^o.
 $C_{12}H_{11}CeO_3$, 867^o.
 $C_{12}H_{11}ClN_2O_4$ Pyruvohydroxamyl chloride, acetoxyime, Bz deriv., 1099^o.
 $C_{12}H_{11}ClN_2O_3S$ Benzenesulfonic acid, *m*-nitro-, chloroaniline salt, 1104^o.
 $C_{12}H_{11}ClO$, Ferulyl chloride, acetate, 1257^o.
 $C_{12}H_{11}I_2N_2O_3$ Adipic acid, α -keto-, 3,4,5-triiodophenylhydrazone, 90^o.
 $C_{12}H_{11}LaO_8$, 887^o.

- C₁₂H₁₁LaO₇, 867².
 C₁₂H₁₁N (See also *Diphenylamine*).
 o-Biphenylamine, 1250⁸.
 C₁₂H₁₁NO Acetimidic acid, naphthyl esters,
 -HCl, 1256⁹, 1257¹.
 1-Naphthol, 4-(α -iminoethyl)-, and -HCl,
 1257¹.
 Phenol, *p*-(p -aminophenyl)-, 403¹.
 6-Quinolol, 2(and 8)-methyl-5-vinyl-, and
 -HCl, 3197⁸.
 C₁₂H₁₁NO₂ Acetamide, *N*-(hydroxy-1-naphthyl)-,
 83⁸, 3364¹.
 Elsholtzanilide, 2896⁷.
 Ketone, 2-hydroxy-1-naphthyl methyl, oxime,
 3364¹.
 1-Naphthaldehyde, methoxy-, oxime, 900⁸;
 and -HCl, 3618⁷.
 Naphthaldeione, tetrahydro-, 1122⁹,
 1123^{1,2}.
 C₁₂H₁₁NO₃ Benzenesulfonanilide, 2670¹.
 2(1)-Benzofuranone, 1,3,5-trimethyl-1-thio-
 cyano-, 911⁷.
 3-Thiophenecarboxanilide, 4-hydroxy-2-
 methyl-, 734⁴.
 C₁₂H₁₁NO₃S₂ Thiochromanoneketohydro-10,6-
 heptathiazine, 741⁸.
 C₁₂H₁₁NO₃ Cinchoninic acid, 1,2-dihydro-2-
 keto-1-methyl-, Me ester, 586¹.
 3-Furancarboxylic acid, 2-(2-pyridyl)-, Et
 ester, and chlorourate, 406³.
 C₁₂H₁₁NO₃S 1-Naphthalenesulfonic acid, 4-acet-
 amido-, 234⁸.
 C₁₂H₁₁NO₄ 3-Indolepropionic acid, 2-carboxy-,
 904⁸, 583⁸.
 Indoxyllic acid, Me ester, acetate, 3602².
 Malonic acid, (3-indylmethyl)-, 583⁸.
 C₁₂H₁₁NO₄S Naphthionic acid, *N*-acetyl-, 3361⁸.
 C₁₂H₁₁NO₄ α,γ -Pentadienic acid, β,δ,δ -tri-
 hydroxy-, δ -lactone, monoacetate, pyridine
 salt, 1798⁸.
 C₁₂H₁₁NO₄S₂ Di-1-phenol-4-sulfonamide, 3605¹.
 C₁₂H₁₁N₂O₃S₂ Benzenestibonic acid, *p*-(p -hy-
 droxyphenylazo)-, 71⁴.
 C₁₂H₁₁N₂ 2,3,6,7-Dibenzo-1,4,5-heptatriazine,
 4,5-dihydro-, 2132².
 C₁₂H₁₁N₂O Aniline, *p*-phenylazoxy-, 2460⁸.
 C₁₂H₁₁N₂O₃ 3-Pyrrolicarboxylic acid, α -(β,β -di-
 cyanovinyl)-2-methyl-, Et ester, 381⁴.
 C₁₂H₁₁N₂O₄ 1,2-Naphthoquinone, 4-methoxy-,
 semicarbazone, 83⁸.
 C₁₂H₁₁N₂O₄S 3(2)-Thiopyrano[4,3]pyrazolone,
 3a,4,6,7-tetrahydro-2-(p -nitrophenyl)-,
 1262².
 C₁₂H₁₁N₂O₄ 1,2,5-Triazolecarboxylic acid, 1-
 phenyl-, di-Me ester, 2269¹, 2690⁴.
 C₁₂H₁₁N₂O₄ Aniline, addn. compd. with 2,4-
 dinitrophenol, 232².
 C₁₂H₁₁N₂ 2,1,3-Benzotriazole, 4,5-diamino-2-
 phenyl-, 2689⁴.
 C₁₂H₁₁NdO₄, 867².
 C₁₂H₁₁NdO₄, 867².
 C₁₂H₁₁O₄P Phosphoric acid, di-Ph ester, 2461^{1,2}.
 C₁₂H₁₁O₄Fr, 867².
 C₁₂H₁₁O₄Fr, 867².
 C₁₂H₁₂ Naphthalene, dimethyl-, 900⁸, 1645⁷,
 1646².
 C₁₂H₁₂Aa₂N₂O Phenol, 2-amino-4-(p -amino-
 phenylarseno)-, P 2907⁷.
 C₁₂H₁₂Aa₂N₂O₂ Arsenophenol, 3,3'-diamino-, P
 2907⁷.
 C₁₂H₁₂Br₂O₂ 2,4-Hexanedione, 5,6-dibromo-
 phenyl-, 2901⁹.
 C₁₂H₁₂Br₂O₂ 3-Pentanone, 1,2-dibromo-1-(3,4-
 methylenedioxyphenyl)-, 1803⁸.
 C₁₂H₁₂Br₂O₂S₂ Propionic acid, β,β' -(4,6-di-
 bromo-*m*-phenylene)dithiobis-, 741¹.
 C₁₂H₁₂ClN₂O₇ Pyrazole, chlorotrimethyl-, pic-
 rate, 2898^{7,8}.
 C₁₂H₁₂Cl₂O Ether, allyl 2,4-dichloro-6-propenyl-
 phenyl-, 72¹.
 Phenol, 2,4-dichloro-6-(β -methyl- Δ^1 -penta-
 dienyl)-, 72¹.
 C₁₂H₁₂Cl₂NO₂ 1,3,2-Oxazin-2-one, tetrahydro-
 4-hydroxy-4-*p*-tolyl-6-(trichloro-
 methyl)-, 3614².
 C₁₂H₁₂FeN₂O₄, 2232².
 C₁₂H₁₂Hg Ethyl 1-naphthyl mercury, 233⁸.
 C₁₂H₁₂Hg₂O₂ Furan, tetrakis(acetoxymercuri)-,
 2686².
 C₁₂H₁₂INO₂ 1,3-Dimethyl-6,7-methylenedioxy-
 quinolinium iodide, 585⁴.
 C₁₂H₁₂INO₂ Cinchoninic acid, 1,2,3,4-tetra-
 hydro-6(?)-iodo-2-keto-, Et ester, 586¹.
 C₁₂H₁₂NO₂P Phosphoric acid, (anilinophenyl)
 ester, salts, 2461^{1,2}.
 C₁₂H₁₂N₂ (See also *Benzidine*).
 Hydrazine, α,α -diphenyl-, -HCl, 736⁴.
 Hydratobenzene, 736⁴.
 o-Phenylenediamine, 4-phenyl-, 237⁸.
 2,9-Pyridindole, 3,4-dihydro-1-methyl-,
 1270¹.
 Pyridine, 2(and 4)-(p-aminobenzyl)-, and
 di-HCl, 94^{1,2}.
 C₁₂H₁₂N₂O Harmalol, salts, 1656⁸.
 C₁₂H₁₂N₂O₃ 3(2)-Thiopyrano[4,3]pyrazolone,
 3a,4,6,7-tetrahydro-2-phenyl-, 1262².
 C₁₂H₁₂N₂O₂ 2,3- α -Naphthazolidone, 6,7,8,9-
 tetrahydro-, oxime, 1123².
 Phenanthroline, tetrahydro-, 1979⁴.
 3-Pyrrolicarboxanilide, 4-hydroxy-2-methyl-,
 734⁴.
 3-Pyrrolicarboxylic acid, 2-(2-pyridyl)-, Et
 ester, 406².
 3-Quinolincarboxylic acid, 2-amino-, Et
 ester, and -HCl, 906⁸.
 C₁₂H₁₂N₂O₂ (See also *Phenobarbital*).
 Acetanilide, *N*-(cyanomethyl)hydroxy-, ace-
 tate, 1704^{2,4}.
 4-Imidazolecarboxylic acid, 2,3-dihydro-2-
 keto-1,3-dimethyl-5-phenyl-, and *Ag* salt,
 3353⁸.
 5-Pyrazolecarboxylic acid, 4-hydroxy-3-
 phenyl-, Et ester, 3904¹.
 2-Pyrrolidinecarboxylic acid, 1-benzalmino-
 5-keto-, 2897².
 C₁₂H₁₂N₂O₄ Hydatoint, 3-acetyl-1-anisyl-, 1795⁴.
 2-Pyrrolidinecarboxylic acid, 5-keto-1-salicyl-
 almino-, 2897².
 C₁₂H₁₂N₂O₄S Harmalolsulfonic acid, 1656⁸.
 C₁₂H₁₂N₂O₄ Barbituric acid, 5-vanillyl-, 2251⁸.
 C₁₂H₁₂N₂O₄S Benzenesulfonic acid, *m*-nitro-,
 PhNH₂ salt, 1103⁹.
 C₁₂H₁₂N₂O₄ Acetonitrile, (3,4,5-trimethoxy-2-
 nitrobenzoyl)-, 912¹.
 C₁₂H₁₂N₂S Urea, α -methyl- β -1-naphthylthio-,
 1457².
 C₁₂H₁₂N₂O₄S₂ Benzenestibonic acid, *p*-(3-amino-
 4-hydroxyphenylazo)-, 71⁴.
 C₁₂H₁₂N₂O₄ Hydrazine, α -(α -aminophenyl)- β -(α -
 nitrophenyl)-, 2133².
 C₁₂H₁₂N₂O₄ Phenol, 2-nitro-4,4'-azobis-, NH₄
 deriv., 1971⁹.
 C₁₂H₁₂O 3(2)-Acenaphthenone, 1,8a-dihydro-,
 84⁴.
 7-Acenaphthenone, 1,2,3,8a-tetrahydro-,
 84⁴.
 Ether, ethyl 2-naphthyl-, 82⁹.
 C₁₂H₁₂O₂ Furan, 2-(benzyloxyethyl)-, 1848⁹.

- Naphthalene, dimethoxy-, 1645⁷.
 Phthalide, 2-butylidene-, 2261⁸.
 —, 2-isobutylidene-, 2260⁸.
 Resorcinol, dihydrophenyl-, 2872⁴.
 $C_{12}H_{10}O_5$ Phthalic acid, dithiol-, cyclic ester of 2,2'-thiobisethanol, 3192⁸.
 $C_{12}H_{12}O_4$ Δ^1 -2-Butenone, 3-methyl-4-(3,4-methylenedioxyphenyl)-, 576⁴.
 1-Indanone, 2-(hydroxymethyl)-, acetate, 582⁸.
 1(2)-Naphthalenone, 3,4-dihydro-7-hydroxy-, acetate, 1123⁸.
 Δ^1 -1,3-Pentenediene, 5-methoxy-1-phenyl-, 2901⁸.
 Δ^1 -3-Pentenone, 1-(3,4-methylenedioxyphenyl)-, 576⁴, 1803⁸.
 $C_{12}H_{12}O_4$ Cinnamic acid, 3,4-methylenedioxy-, Et ester, 1453⁹.
 Pyruvic acid, benzoyl-, Et ester, 3900⁸.
 $C_{12}H_{12}O_4$ Acetic acid, 3,4-methylenedioxybenzoyl-, Et ester, 3356⁷.
 Acetophenone, 3,5-dihydroxy-, diacetate, 1803⁸.
 Ferulic acid, acetate, 1257⁸.
 $C_{12}H_{11}BrN_2$ Cyclopentanenitrile, 1-*o*(*m* and *p*)-bromoanilino-, 1635⁸.
 $C_{12}H_{11}BrO_4$ Salicylic acid, bromoisovalerate, 1866⁹.
 $C_{12}H_{11}ClIN_2O_7$ 4-Chloro-1,2,3-trimethylpyrazolium iodide, picrate, 2898⁷.
 $C_{12}H_{11}ClIN_2$ Cyclopentanenitrile, 1-*o*(*m* and *p*)-chloroanilino-, 1635⁷.
 $C_{12}H_{11}ClIN_2O_2$ Crotonanilide, β -amino- α -chloroacetyl-, 734³.
 $C_{12}H_{11}ClIN_2O_4$ Acetanilide, α -chloro-*o*-formyl-, (*o*-carboxyoxime), 1119⁸.
 $C_{12}H_{11}ClO$ Cinnamoyl chloride, β -isopropyl-, 229⁸.
 —, β -propyl-, 229⁸.
 Hydrosorbonyl chloride, β -phenyl-, 229⁸.
 1-Indanpropionyl chloride, 84⁴.
 1-Naphthaleneacetyl chloride, 1,2,3,4-tetrahydro-, 84⁴.
 β -Pentenoyl chloride, γ -methyl- β -phenyl-, 229⁸.
 $C_{12}H_{11}Cl_2O_4$ 1-Propanol, 2-methyl-1-(trichloromethyl)-, benzoate, 1625⁹.
 $C_{12}H_{11}Cl_2O_4$ Butyrophenone, γ -trichloro- β -hydroxy-3,4-dimethoxy-, 3614⁸.
 $C_{12}H_{11}Hg_2NO_8$ Pyrrole, 2,3,4,5-tetrakis(acetoxymercuri)-, 2686⁸.
 $C_{12}H_{11}N_2O_2$ 7-Acetamido-8-hydroxy-1-methylquinolinium iodide, 1461⁸.
 $C_{12}H_{11}N_2O_4$ Adipic acid, α -keto-, *p*-iodophenylhydrazones, 90⁸.
 $C_{12}H_{11}N$ 1-Indanpropionitrile, 84⁴.
 $C_{12}H_{11}NO$ 3(2)-Acenaphthenone, 1,8a-dihydro-, oxime, 84⁴.
 7-Acenaphthenone, 1,2,3,8a-tetrahydro-, oxime, 84⁴.
 2(3)- α -Naphthalzone, 6,7,8,9-tetrahydro-, 1123³.
 $C_{12}H_{11}NO_2$ Acetamide, *N*-(5,6,7,8-tetrahydro- α -keto-2-naphthyl)-, 1124⁴.
 β -Butenic acid, α -(ethylimino)- γ -phenyl-, 2882⁸.
 2-Indolecarboxylic acid, methyl-, Et ester, 912⁸, 913¹.
 3-Indolepropionic acid, Me ester, 1263⁸.
 Quinoline, 6,7-dimethoxy-3-methyl-, and -HCl, 585⁷.
 α -Toluic acid, α -cyano- α -ethyl-, Me ester, 906¹.
 $C_{12}H_{11}NO_2$ (See also *Pyranthin*.)
 Acetanilide, 2-allyl-4,5-methylenedioxy-, 3192⁸.
 Benzofurandione, isopropylmethyl-, oxime, 1678⁷.
 Δ^1 -2-Butenone, 3-methyl-4-(3,4-methylenedioxyphenyl)-, oxime, 576⁴.
 Cinchoninic acid, 1,2,3,4-tetrahydro-2-keto-, Et ester, 586¹.
 —, 1,2,3,4-tetrahydro-2-keto-1-methyl-, Me ester, 586¹.
 Indole, 1-acetyl-5,6-dimethoxy-, 1650¹.
 Ketone, methyl 5,6,7,8-tetrahydro-1-nitro-2-naphthyl, 84⁴.
 Δ^1 -3-Pentenone, 1-(3,4-methylenedioxyphenyl)-, oxime, 576⁴, 1803⁸.
 $C_{12}H_{11}NO_3S$ Toluene-sulfonic acid, pyridine addn. compd., 573⁸.
 $C_{12}H_{11}NO_3S_2$ Benzoketohydro-1,5-heptathiazine-8-thiopropionic acid, 741⁸.
 Propionic acid, β -(6-amino-3,4-dihydro-4-keto-1,2-benzothiopyranilylmercapto)-, 741⁸.
 $C_{12}H_{11}NO_4$ Cinnamaldehyde, 4,5-dimethoxy- α -methyl-2-nitro-, 585⁸.
 Glycine, *N*-acetyl-*N*-(*p*-hydroxyphenyl)-, acetate, 1794⁴.
 $C_{12}H_{11}NO_4S_2$ Propionic acid, β , β' -(4-nitro-*m*-phenylene)dithiois-, 741¹.
 $C_{12}H_{11}NO_4$ Mandelic acid, 2-ethoxy-5-nitro-, acetate, 233⁷.
 $C_{12}H_{11}N_2$ Pyrrole, methyltolylazo-, 2451⁸.
 $C_{12}H_{11}N_2O_8$ 2,4-Thiazolodione, 3-phenyl-, 2-isopropylidenehydrazones, 245⁷.
 $C_{12}H_{11}N_2O_8S_2$ Δ^1 -1,3,4-Thiodiazoline, 4-acetyl-2-methylmercapto-5-*p*-tolylimino-, 3199⁸.
 $C_{12}H_{11}N_2O_4$ Cyclopentanenitrile, 1-*m*(and *p*)-nitroanilino-, 1635⁸.
 1-Pyrazolecarboxamide, 5-(2,5-cresyl)-3-methyl-, 2471⁷.
 $C_{12}H_{11}N_2O_4$ 3(4)-Quinazolinecarbamic acid, 4-keto-2-methyl-, Et ester, 2697⁸.
 $C_{12}H_{11}N_2O_4$ 2(1)-Quinoxalone, 1-acetyl-4-ethyl-3,4-dihydro-6-nitro-, 383⁷.
 $C_{12}H_{11}N_2O_4$ Phthalide, 6-isopropylidenehydrazono-5-methoxy-3-nitro-, 3358¹.
 Protocatechualdehyde, diacetate, semicarbazone, 1107⁸.
 $C_{12}H_{11}N_2O_4$ Azoxybenzene, *p*-nitrosohydroxylamine, ammonium salt, 3048⁸.
 Glyoxime, diacetyl-, peroxide, oxime, phenylhydrazones, 1099¹.
 $C_{12}H_{11}N_2O_4$ Hydroxylamine, nitrophenylnitroso-, phenylhydrazones compd., 3048⁸.
 $C_{12}H_{11}N_2O_8S$ Imidazole, 2-(ethylmercapto)-4-(or 5)-methyl-, picrate, 3614⁸.
 $C_{12}H_{11}N_2O_4S$ 5-Pyrazolone, 1,3,4-trimethyl-, picrate, 2898⁷.
 $C_{12}H_{11}As_2Cl_2N_2O_2$ See *Arsphenamine*.
 $C_{12}H_{11}BrN$ Carbazole, bromohexahydro-, 2898⁸.
 $C_{12}H_{11}BrNO_2$ Cyclopentanecarboxylic acid, 1-*o*(*m* and *p*)-bromoanilino-, 1635⁸.
 $C_{12}H_{11}BrNO_2$ Salicylamide, bromoisovaleryl-, 1866⁹.
 $C_{12}H_{11}Br_2O_2$ 2-Butanone, 4-*p*-anisyl-3,4-dibromo-3-methyl-, 1803⁸.
 $C_{12}H_{11}ClIN_2$ Benzylchlorodimethylpyrazolium iodide, 2898⁷.
 $C_{12}H_{11}ClINO_2$ Cyclopentanecarboxylic acid, 1-*o*(*m* and *p*)-chloroanilino-, 1635⁷.
 $C_{12}H_{11}ClIN_2$ 3(4)-Pyridone, 5,6-dihydro-2-methyl-, *m*-chlorophenylhydrazones, and -HCl, 1269⁸, 1270¹.
 $C_{12}H_{11}Cl_2N_2O_2$ Propionamide, *N*, *N'*-*o*(*m* and *p*)-phenylenebis(β -chloro-, 1979⁸.

- C₁₂H₁₄Cl₂N₂Pt, 2856¹.
 C₁₂H₁₄Cl₂N Butyrimidyl chloride, α , α -dichloro-*N*-ethyl- γ -phenyl-, 2875⁹.
 C₁₂H₁₄IN 1-Ethyl-3-methylquinolinium iodide, 585⁵.
 C₁₂H₁₄INO 6-Methoxy-1,3-dimethylquinolinium iodide, 585⁷.
 C₁₂H₁₄I₂N₂Sn, 3571⁴.
 C₁₂H₁₄N₂ Ethylenediamine, *N*-1 (and 2)-naphthyl-, P 916⁹.
 C₁₂H₁₄N₂O Carbazole, 1,2,3,4,4a,9a-hexahydro-9-nitroso-, 3199⁸.
 Nicotinamide, *N*, *N*-diallyl-, P 250⁹.
 C₁₂H₁₄N₂OS Uracil, 6-ethyl-5,6-dihydro-3-phenyl-4-thio-, 57⁸.
 C₁₂H₁₄N₂O₂ Carbazole, hexahydronitro-, 2898^{1,3}.
 Hydantoin, 1,5,5-trimethyl-3-phenyl-, 1795².
 Isobutyronitrile, α -(*p*-hydroxyanilino)-, acetate, 1794³.
 2-Pyrrolidone, 1-acetamido-5-phenyl-, 2897².
 Uracil, 6-ethyl-5,6-dihydro-3-phenyl-, 57⁸.
 C₁₂H₁₄N₂O₂ Ketone, methyl 5,6,7,8-tetrahydro-1-nitro-2-naphthyl, oxime, 84⁹.
 C₁₂H₁₄N₂O₄ Benzoic acid, 5-nitro-2 (1 piperidyl)-, 2681⁴.
 Carbanilic acid, *N*-acetyl-*o*-formyl-(?), Et ester, oxime, 1119⁹.
 Cyclopentanecarboxylic acid, *m* (and *p*)-nitroanilino-, 1635⁸.
 C₁₂H₁₄N₂O₄ Benzenecarboxylic acid, *o*-acetyl-, di-Me ester, 1124².
 Carbanilic acid, *o*-formyl-, Me ester, *O*-carbethoxyoxime, 1119².
 C₁₂H₁₄N₂O₄ Phloroisocaprophenone, dinitroso-, 2250⁹.
 C₁₂H₁₄N₄ Compd., m. 112.5°, from AcH and 2-amino-pyridine, 94⁸.
 C₁₂H₁₄N₄O₂ 1,2,4-Triazole, 3,5-diethyl-1-(nitrophenyl)-, 3200⁹.
 C₁₂H₁₄N₄O₄ Isodialuric acid, 1,3-dimethyl-, phenylhydrazine, 1447⁸.
 C₁₂H₁₄O 3-Acenaphthenol, 1,2,3,8a-tetrahydro-, 84⁸.
 2-Hexenone, 4-phenyl-, 229⁶.
 1(2)-Naphthalenone, 3,4-dihydrodimethyl-, 910⁹, 1123⁷.
 —, 3-ethyl-3,4-dihydro-, 1123⁸.
 C₁₂H₁₄O₂ Benzene, *m* (and *p*)-dipropionyl-, 1980^{7,8}.
 2(1)-Benzofuranone, 1,1,4,6-tetramethyl-, 1117⁸.
 β -Butenic acid, γ -phenyl-, Et ester, 228⁴.
 Δ^3 -2-Butenone, 4-*p*-anisyl-3-methyl-, 1803⁵.
 4-Chromanone, 3,6,8-trimethyl-, 1117⁶.
 Cinnamic acid, β -isopropyl-, 229⁴.
 —, methyl-, Et ester, 228⁸, 1453⁹.
 —, β -propyl-, 229³.
 Hydrocinnamic acid, α -allyl-, 582¹.
 —, α -(β -hydroxypropyl)-, γ -lactone, 1007¹.
 Hydrosorbic acid, β -phenyl-, 220².
 1-Indanpropionic acid, 84⁴.
 2-Naphthoic acid, 1,2,3,4-tetrahydro-4-methyl-, 582¹.
 β -Pentenic acid, γ -methyl- β -phenyl-, 229⁴.
 Δ^1 -3-Pentenone, 1-*p*-anisyl-, 1803⁵.
 Phthalide, 2,2-diethyl-, 1980⁹.
 —, 2-isobutyl-, 2260⁹.
 C₁₂H₁₄O₂S₂ Phthalic acid, dithiol-, di-Et ester, 3192⁴.
 C₁₂H₁₄O₂ Cinnamic acid, methoxy-, Et ester, 1453⁹, 3610⁴.
 Hydrocinnamic acid, α -formyl-, Et ester, 906⁸.
 Isobutyrophenone, α -hydroxy-, acetate, 3611⁷.
 Ketone, cyclopentyl 2,4-dihydroxyphenyl-, 3050⁹.
 C₁₂H₁₄O₄ Apioi, 772³, 2256⁷.
 Glyoxylic acid, (4,6-dimethyl-*o*-anisyl)-, Me ester, 1117¹.
 —, (4,6-dimethyl-*o*-phenetyl)-, 1117¹.
 —, (5-methyl-*o*-anisyl)-, Et ester, 1117¹.
 —, (5-methyl-*o*-phenetyl)-, Me ester, 1117¹.
 Hydrocinnamic acid, 3,4-methylenedioxy-, Et ester, 1453⁹.
 Isoapioi, 2256⁷.
 Phthalic acid, di-Et ester-, 299⁴, 2359⁹.
 —, Me Pr and Me isopropyl esters, 1642⁴.
 C₁₂H₁₄O₂S₂ Propionic acid, β , β' -*m*-phenylene-dithiolis-, 740⁹.
 C₁₂H₁₄O₄ Homopiperonylic acid, 6-(methoxy-methyl)-, Me ester, 1270⁷.
 Isophthalic acid, 4-hydroxy-, di-Et ester, 1980⁹.
 C₁₂H₁₄AsClN₂O₆ Arsanilic acid, *N*-[*N*-(*N*-chloroacetyl)glycyl]glycyl-, 711¹.
 C₁₂H₁₄Br Naphthalene, 1-(β -bromoethyl)-1,2,3,4-tetrahydro-, 84⁶.
 C₁₂H₁₄BrN₂O Cyclopentanecarboxamide, 1-*o* (*m* and *p*)-bromoanilino-, 1635⁸.
 C₁₂H₁₄BrN₂S Benzothiazole, 1-(amylamino) 5-bromo-, 584⁶.
 —, 5-bromo-1-isamylamino-, 584⁶.
 C₁₂H₁₄BrN₂S Benzothiazole, 5-bromo-1-isamylamino-, dibromide, 584⁶.
 C₁₂H₁₄BrN₂S Benzothiazole, 1-(amylamino)-5-bromo-, tetrahydride, 584⁶.
 C₁₂H₁₄ClN₂O Cyclopentanecarboxamide, 1-*o* (*m* and *p*)-chloroanilino-, 1635⁷.
 C₁₂H₁₄ClN₂O₂S Xylenesulfonyl chloride, *tert*-butyl-3,5-dinitro-, 3604⁷.
 C₁₂H₁₄ClO Benzoyl chloride, *p*-(α -methylisobutyl)-, 1804².
 Valeryl chloride, β -benzyl-, 1123⁸.
 —, β -methyl- γ -phenyl-, 1123⁷.
 C₁₂H₁₄ClNO Butyramide, α , α -dichloro-*N*-ethyl- γ -phenyl-, 2875⁹.
 C₁₂H₁₄FN₂O₂S Xylenesulfonyl fluoride, *tert*-butyl-3,5-dinitro-, 3604⁷.
 C₁₂H₁₄IO₂ Acetic acid, (iodoacetyloxy)-, 1678⁷.
 C₁₂H₁₄KO₂ 1,3-Butanedione, 1-phenyl-, K deriv., EtOH compd., 3357⁴.
 C₁₂H₁₄LiO₂ 1,3-Butanedione, 1-phenyl-, Li deriv., EtOH compd., 3357⁴.
 C₁₂H₁₄N 3-Acenaphthenamine, 1,2,3,8a-tetrahydro-, and *HCl*, 84⁴.
 Hydrocinnamonitrile, *p*-isopropyl-, 1461².
 Valeronitrile, β -benzyl-, 1123⁷.
 C₁₂H₁₄NO Acetamide, acetyl-tetrahydro-, 1678⁸.
 β -Butenamide, α , β -dimethyl-, 227⁹.
 Δ^3 -2-Butenone, 4-(*p*-dimethylaminophenyl)-, 1107⁴.
 Hydrosorbamide, β -phenyl-, 229².
 1-Indanpropionamide, 84⁴.
 1(2)-Naphthalenone, 3,4-dihydro-4,7-dimethyl-, oxime, 910⁹.
 —, 7-dimethylamino-3,4-dihydro-, 1123³.
 —, 3-ethyl-3,4-dihydro-, oxime, 1123⁴.
 β -Pentenamide, γ -methyl- β -phenyl-, 229⁴.
 C₁₂H₁₄NO₂ Δ^3 -2-Butenone, 4-*p*-anisyl-3-methyl-, oxime, 1803⁵.
 Crotonophenone, β -amino-2-methoxy-5-methyl-, 2471³.
 —, 2-hydroxy-3-methyl- β -methylamino-, 2472².
 1(2)-Naphthalenone, 3,4-dihydro-7-(β -hydroxyethylamino)-, 1123³.
 Δ^1 -3-Pentenone, 1-*p*-anisyl-, oxime, 1803⁵.
 C₁₂H₁₄NO₂ (See also *Hydrocotarnine*.)

- Benzoic acid, *p*-propionylamino-, Et ester, 236⁹.
- Hydrastinine, methyl-, 1980⁹.
- Isobutyranilide, α -hydroxy-, acetate, 3611⁷.
- 3-Pyrrolicarboxylic acid, 5-formyl 2-isobutenyl-, Et ester, 381⁴.
- α -Toluic acid, *p*-acetamido- α -ethyl-, 2670⁹.
- Tyrosine, *N*-isopropylidene(?), 3900².
- Valeric acid, β -benzamido-, 57⁸.
- $C_{12}H_{11}NO_4$** Malonic acid, (2-pyrrolylmethylene)-, di-Et ester, 381⁷.
- $C_{12}H_{11}NO_5$** Ethylsulfuric acid, 1-naphthylamine salt, 53².
- Propylsulfuric acid, quinoline salt, 53².
- $C_{12}H_{11}NO_5S_2$** Propionic acid, β , β' -(4-amino-phenylene)dithiobis-, and -HCl, 741¹.
- $C_{12}H_{11}NO_6$** Hydracrylaldehyde, β -(4,5-dimethoxy-2-nitrophenyl) α -methyl, 585⁶.
- Propiophenone, 3,4,5-trimethoxy-2-nitro-, 912¹.
- $C_{12}H_{11}N_3$** 3(4)-Pyridone, 5,6 dihydro-2-methyl, phenylhydrazone, and -HCl, 1269⁹.
- 1,2,4-Triazole, 3,5-diethyl-1-phenyl-, and HgCl₂ salt, 3201¹.
- $C_{12}H_{11}N_3O$** Pentenone, phenyl, semicarbazone, 228⁶, 229⁶.
- Urea, α - (α -cyanoisopropyl) - α - methyl- β -phenyl-, 1795⁹.
- $C_{12}H_{11}N_3O_2$** 2(1)-Benzofuranone, 1,1,6-trimethyl-, semicarbazone, 1117⁸.
- 4-Chromanone, 3,8 dimethyl-, semicarbazone, 1117⁸.
- Naphthaldehyde, 5,6,7,8 - tetrahydrohydroxy-, semicarbazone, 1983⁷.
- $C_{12}H_{11}N_3O_2$** 1,3 Butanedione, 1-(2,5 cresyl), semicarbazone, 2472².
- Cyclopentanecarboxamide, 1-*m*-(and *p*)-nitroanilino-, 1635⁹.
- 1,3,5,4 - Oxidiazin - 4 - one, tetrahydro - 2-hydroxy - 3,5 - dimethyl - 6 - methylimino-2 phenyl-, 2130⁷.
- $C_{12}H_{11}N_3O_4$** Carbanilic acid, *o* (acetamidocarhamyl)-, Et ester, 2697⁸.
- Carbazic acid, β -(*N*-acetylthranoyl), Et ester, 2697⁸.
- Cyclohexylamine, *N* - (2,4 - dinitrophenyl)-, 1102³.
- $C_{12}H_{11}N_3O_5$** Asaronaldehyde, semioxamazone, 1974³.
- m* - Phenylenediamine, *N*, *N'* - diacetyl-4-ethoxy-2-nitro-, 2260⁸.
- $C_{12}H_{11}O_5P$** Phosphinedicarboxylic acid, phenyl, di Et ester, 3049⁷.
- $C_{12}H_{11}BrNO_4$** 3-Pyrrolicarboxylic acid, 2-(bromo-methyl)-5-carbomethoxy-4-methyl-, 1041¹.
- $C_{12}H_{11}BrN_2S$** Benzothiazole, 1 (amylamino)-, dibromide, -HBr, 584³.
- , 1-isoamylamino-, dibromide, -HBr, 584³.
- $C_{12}H_{11}ClNO$** Carbanilyl chloride, *N*-isoamyl-, 1108⁶.
- $C_{12}H_{11}ClN_3$** 1,2,4-Triazole, 3,5-dimethyl-1-phenyl-, ethochloride, 3200⁶.
- $C_{12}H_{11}Hg$** Cyclohexyl phenyl mercury, 233⁵.
- $C_{12}H_{11}HgO_4$** Carvacrol, 3(or 5)-(acetoxymercuri)-, 69⁹.
- Phenol, 2-(acetoxymercuri)-4-*tert*-butyl-, 69⁹.
- $C_{12}H_{11}INO_2$** 3,4 - Dihydro - 6,7 - dimethoxy - 2-methylisoquinolinium iodide, 1125⁶.
- $C_{12}H_{11}IN_3$** 1,2,4 - Triazole, 3,5 - dimethyl - 1-phenyl-, ethiodide, 3200⁶.
- $C_{12}H_{11}N_3$** 1,1'-Bipyrrrole, 2,5,2',5'-tetramethyl-, 243⁷.
- Carbazole, aminohexahydro-, 2898^{2,3}.
- $C_{12}H_{11}N_3O_2$** Benzimidazole, 5-ethoxy-2-ethoxymethyl-, P 158¹.
- Biacyetyl, *p*-phenethylhydrazone, 1973².
- 2-Butanone, oxime, *o*(and *p*)-methylcarbanilates, 1628⁸.
- Isobutyramide, α - benzamido - *N* - methyl-, 1813⁹.
- Pentanone, oxime, carbanilate, 1628⁸.
- $C_{12}H_{11}N_3O_3$** *o* Acetotoluide, 5-isopropyl-3-nitro-, 903³.
- Hydrastinine, methyl-, oxime, and -HCl, 1990².
- Ornithine, *N* δ -benzoyl, 258⁸.
- Valeric acid, β -(phenylcarbamido)-, 57⁸.
- $C_{12}H_{11}N_2O_5$** Hydrazine, α -acetyl- β -[6-(hydroxymethyl)-*o*-veratroyl]-, 3357⁸.
- $C_{12}H_{11}N_2O_6$** Phenethylamine, *N*, *N*-dimethyl-*m*-nitro-, oxalate, 1250⁸.
- $C_{12}H_{11}N_2O_5S$** Valeric acid, β (and γ)-(5-nitro-*o*-tolylsulfonamido)-, 578⁹.
- $C_{12}H_{11}N_2S$** Benzothiazole, 1-(amylamino)-, 584³.
- , 1-isoamylamino-, 584³.
- $C_{12}H_{11}N_4$** 1,2,4-Triazole, 1-(aminophenyl)-3,5-diethyl-, 3200⁹.
- $C_{12}H_{11}N_4O_3$** 1,3-Butanedione, 1-(2,3-cresyl)-, 1-oxime, 3 semicarbazone, 2471⁸.
- $C_{12}H_{11}N_4O_8$** *d*-Glucose, dinitrophenylhydrazone, 2879⁸.
- $C_{12}H_{11}O$** Anisole, 2-allyl 1,6-dimethyl, 71⁸.
- , 2,1 dimethyl 6-propenyl-, 71⁸.
- Caprophenone, 908⁸.
- Ether, ethyl 5,6,7,8 tetrahydro-2-naphthyl, 1983⁷.
- Ethylene oxide, (δ phenylbutyl)-, 3899⁷.
- 1 Naphthaleneethanol, 1,2,3,4 tetrahydro-, 84⁵.
- $C_{12}H_{11}O_2$** Acetic acid, di- Δ^2 -cyclopentenyl-, 901⁶.
- Acetophenone, 4 - hydroxy - 5 - isopropyl-2-methyl, 1971⁶.
- Benzoic acid, isoamyl ester, 55⁸.
- , *p*-(α -methylisobutyl)-, 1804².
- Butyric acid, γ -phenyl-, Et ester, 1453⁸.
- Isobutyric acid, 2,4-xylyl ester, 1117⁸.
- Isobutyrophenone, hydroxydimethyl, 1117⁸, 3611⁸.
- Phthalide, 4,5 dihydro-2-isobutyl-, 2261¹.
- Propiophenone, 4-hydroxy-3-propyl-, 1974⁷.
- Resorcinol, 4-cyclohexyl-, 3046⁸.
- , 4-(cyclopentylmethyl)-, 3050⁸.
- Salicylaldehyde, 5-isoamyl-, 69⁹.
- Valeric acid, β -benzyl-, 1123⁸.
- , β -methyl- γ -phenyl-, 1123⁷.
- Veratrole, 4- Δ^2 -butenyl-, 1803⁸.
- $C_{12}H_{11}O_3$** Acetic acid, cymyloxy-, 1678⁷.
- Benzoic acid, *p*-isopropoxy-, Et ester, 81⁸.
- Hydrocinamic acid, *p*-methoxy-, Et ester, 1453⁸.
- Salicylic acid, Am ester, 3047⁸.
- $C_{12}H_{11}O_4$** Aspidinol, P 3105⁹.
- Hydrocinamic acid, 2,5-dimethoxy-, Me ester, 2260⁸.
- $C_{12}H_{11}O_5$** Δ^2 -Cyclohexenecarboxylic acid, 4-hydroxy-6-keto-2,2,3-trimethyl-, acetate, 1259².
- 3,4-Furandicarboxylic acid, 2,5-dimethyl-, di-Et ester, 3899⁹.
- $C_{12}H_{11}O_5S$** Glutaconic acid, α , γ -diacetyl-, Et Me ester, 1266⁷.
- $C_{12}H_{11}O_7$** See *Arbutin*.
- $C_{12}H_{17}AsBrNO_4$** Arsanilic acid, *N*-(α -bromoisocaproyl)-, 71².
- $C_{12}H_{17}AsN_3O_6$** Arsanilic acid, *N*-[*N*-(*N*-glycylglycyl)glycyl]-, 71¹.

- C₁₃H₁₇BrIN Benzyl(β -bromoallyl)dimethylammonium iodide, 53⁸.
- C₁₃H₁₇BrINO₂ (6 - Bromohomopiperonyl)trimethylammonium iodide, 1270⁷.
- C₁₃H₁₇BrN₂O₂ Barbituric acid, 5- β -bromoallyl-5- α -methylbutyl-, P 250⁷.
- C₁₃H₁₇BrN₂O₄ Rhamnose, β -bromophenylhydrazine, 1969¹.
- C₁₃H₁₇BrN₂S Urea, α -amyl- β -(β -bromophenyl)thio-, 584⁴.
- , α -(β -bromophenyl)- β -isoamylthio-, 584⁴.
- C₁₃H₁₇ClN₂ Hydrazine, α -(β -chlorophenyl)- α -cyclohexyl-, and -HCl, 2672².
- C₁₃H₁₇ClN₂O₇ (β -Chloroethyl)ethylidimethylammonium picrate, 2660⁷.
- C₁₃H₁₇ClO₂ Camphene, hydrate, trichloroacetate, 2890⁸.
- Isoborneol, trichloroacetate, 2890⁸.
- C₁₃H₁₇FO₂S Xylenesulfonyl fluoride, *tert*-butyl-, 3604⁷.
- C₁₃H₁₇N Cyclohexylamine, *N*-phenyl-, and salts, 1102⁸, 1799⁹.
- Quinoline, tetrahydrotrimethyl-, 2696⁷, 2722⁸.
- C₁₃H₁₇NO 2-Butanone, 4-(β -dimethylaminophenyl)-, 1107⁴.
- Butyramide, *N*-ethyl- γ -phenyl-, 2875⁸.
- Ketone, propyl 6-propyl-3-pyridyl-, 2130⁴.
- C₁₃H₁₇NO₂ Butyric acid, β -anilino-, Et ester, and -HCl, 2870⁸.
- , α -ethylamino- γ -phenyl-, and -HCl, 2882⁸.
- Glycine, *N*-(γ - β -tolylpropyl)-, -HCl, 1461¹.
- Hydrocinnamamide, β -methoxy-*N*, *N*-dimethyl-, 2669⁸.
- C₁₃H₁₇NO₂ Cyclohexanecarboxylic acid, α -cyano-3-keto-1-methyl-, Et ester, 1103⁸.
- 2-Pyrroleacetic acid, 4-ethyl- α -keto-3,5-dimethyl-, Et ester, 2701⁸.
- Pyrrolecarboxylic acid, 5-butyryl-2-methyl-, Et ester, 382².
- , dimethylpropionyl-, Et ester, 382¹.
- C₁₃H₁₇NO₂ Anthranilic acid, *N*, *N*-bis(β -hydroxyethyl)-, Me ester, -HCl, 2467⁹.
- Δ^1 -1,5-Hexenedicarboxylic acid, 5-cyano-, Et Me ester, 2659⁴.
- C₁₃H₁₇NO₂S Valeric acid, *N*-methylphenylsulfonamido-, 257⁸, 258⁷.
- C₁₃H₁₇N₂O 2-Butanone, 3- β -tolyl-, semicarbazone, 3051².
- Isovalerophenone, semicarbazone, 908⁴.
- α -Tolualdehyde, β , α , α -trimethyl-, semicarbazone, 3051².
- Valerophenone, semicarbazone, 908⁴.
- C₁₃H₁₇N₂O₂ Acetophenone, 4-hydroxy-3-propyl-, semicarbazone, 1974⁷.
- Isobutyrophenone, 2-hydroxy-5-methyl-, semicarbazone, 1117⁹.
- C₁₃H₁₇N₂O₂ Benzaldehyde, 4-isopropoxy-3-methoxy-, semicarbazone, 3612².
- , 3-methoxy-4-propoxy-, semicarbazone, 3612².
- C₁₃H₁₇ Benzene, hexamethyl-, 1932⁸.
- C₁₃H₁₇BeO₄ 1,3-Cyclohexanedione, 5,5-dimethyl-, Be complex salt, 394².
- C₁₃H₁₇Br₂O₂ Dibromide, m. 172-3°, of acid from decahydro-1-hydroxy-1-naphthaleneacetic acid, 1113⁷.
- C₁₃H₁₇IN 7,8-Benzoseptamethylenimine, methiodide, 2696².
- C₁₃H₁₇IN₂ Ethylenediamine, *N*-(1,2,3,4-tetrahydro-2-naphthyl)-, and di-HCl, 566⁴, 1102⁷.
- Hydrazine, α -cyclohexyl- α -phenyl-, and salts, 1102⁷.
- C₁₃H₁₇N₂O Ketone, propyl 6-propyl-3-pyridyl, oxime, 2130⁴.
- Nicotinamide, *N*, *N*-dipropyl-, P 250⁸.
- 2,4-Xyldine, *N*-butyl-*N*-nitroso-, 2670⁸.
- C₁₃H₁₇N₂O₂ 2,4-Xyldine, *N*-butyl-5-nitro-, 2670⁸.
- C₁₃H₁₇N₂O₂ Urea, [γ -(3-hydroxy- β -anisyl)-*sec*-butyl]-, 1449⁹.
- C₁₃H₁₇N₂O₄ 4,5-Pyridazinedicarboxylic acid, 4,5-dihydro-3,6-dimethyl-, diethyl ester, 202⁸.
- Pyrroledicarboxylic acid, aminodimethyl-, diethyl ester, 202⁸.
- C₁₃H₁₇N₂S Urea, α -amyl- β -phenylthio-, 584⁴.
- C₁₃H₁₇N₂O 3-Pentanone, 4-anilinosemicarbazone, 68⁸.
- C₁₃H₁₇N₂O₂ 2,5-Piperazinedione, 1,4-dimethyl-, *m*-phenylenediamine addn. compd., 1797².
- C₁₃H₁₇N₂O₂ Cyclohexanecarboxylic acid, α -cyano-3-keto-1-methyl-, Me ester, semicarbazone, 1103⁸.
- C₁₃H₁₇N₂O₂ 2-Piperidine, 3-acetamido-1-(*N*, *N*'-diacetylguanlyl)-, 360⁸.
- C₁₃H₁₇N₂O₂S 2,5-Piperazinedione, 3,3'-dithiodimethylenebis[6-methyl-, 57⁹, 3071¹.
- C₁₃H₁₇N₂O₂ Isobutylamine, *N*, *N*-dimethyl-, picrate, 2660⁷.
- Trimethylpropylammonium picrate, 2660⁷.
- C₁₃H₁₇N₂O₂ Ethyl(β -hydroxyethyl)dimethylammonium picrate, 2660⁸.
- C₁₃H₁₇N₂O₂ Ethanol, 2-(β -dimethylaminoethoxy)-, picrate, 3889⁸.
- C₁₃H₁₇N₂O₂ Guanidine, α -isoamyl-, picrate, 62⁹.
- C₁₃H₁₇O Cyclohexanone, 2- Δ^1 -cyclohexenyl-, 1103¹.
- , 2-cyclohexylidene-, and salts, 231⁴.
- Cyclopentanone, 2-ethyl-2- Δ^1 -cyclopentenyl-, 1103¹.
- C₁₃H₁₇O₂ Acid, m. 155°, from decahydro-1-hydroxy-1-naphthaleneacetic acid, 1113⁸.
- Δ^1 -Cyclohexenecarboxylic acid, 6- α -hydroxyamyl-, lactone, 2261⁸.
- , 6-(α -hydroxyisoamyl)-, lactone, 2260⁸.
- Resorcinol, hexyl-, P 918⁸, 2291¹, 3235⁴, 3644⁷.
- C₁₃H₁₇O₂ 1,2-Butanediol, 1-anisyl-2-methyl-, 3609⁸.
- Cyclopentanecarboxylic acid, 1-(2-ketoethyl-2-pentyl)-, 1103¹.
- 5,6-Spirodecane-1-carboxylic acid, 3-keto-4-methyl-, 3188¹.
- C₁₃H₁₇O₂ 2-Camphanecarboxylic acid, 6-hydroxy-, formate, 401⁸.
- Δ^1 -Cyclohexenecarboxylic acid, 4-hydroxy-2,2,3-trimethyl-, acetate, 1250⁸.
- Δ^1 - α -Cyclopentanemalononic acid, di-Et ester, 227⁹.
- Δ^1 -Cyclopentanemalononic acid, α -butyl-, 901¹.
- C₁₃H₁₇O₂ 1,3-Cyclopentanedicarboxylic acid, 1-hydroxy-4,4,5-trimethyl-, acetate, 1259¹.
- C₁₃H₁₇AsN₂O₄ Arsanilic acid, *N*-leucyl-, 71¹.
- C₁₃H₁₇ClO₂ Mannose, diacetone-, 1-chlorohydrin, 1634².
- C₁₃H₁₇N Benzylamine, α -*tert*-amyl-, and -HCl, 3346⁸.
- Phenethylamine, β -ethyl-*N*, *N*-dimethyl-, 2669².

- Propylamine, γ - *p* - cumenyl-, and -HCl, 1461³.
- 2,4-Xylidine, *N*-butyl-, 2670⁸.
- C₁₂H₁₁NO Amide, m. 119°, of acid from decahydro - 1 - hydroxy - 1 - naphthaleneacetic acid, 1113⁷.
- Benzyl alcohol, α -(α -aminoamyl)-, 908⁴.
- 2 - Butanol, 4 - (*p* - dimethylaminophenyl)-, 1107⁸.
- Propylamine, γ - *p* - anisyl - *N,N* - dimethyl-, 2669⁸.
- C₁₂H₁₁NO₂ Δ^1 - 3 - Hexenone, 1,1' - iminobis-, 2130⁸.
- Phenethylamine, dimethoxydimethyl-, 1255⁸, 2669⁸.
- C₁₂H₁₁N₂O₂ 2 - Camphanenitrile, 2 - (methoxynitrosoamino)-, 2679⁸.
- C₁₂H₁₁N₂O₂ Spiro[1,3,5,2 - oxadiazine - 2,4'(3')-pyrimidine] - 4,2',6'(3,1',5') - trione, 5,6 - dihydro - 3,5,1',3',5' - pentamethyl-6-methylimino-, and *derivs.*, 2131², 2132¹.
- C₁₂H₁₂ Hydrocarbon, b. 215-7°, from 3-methylcyclopentanone, 900⁸.
- C₁₂H₁₁BrNO Δ^1 - 2 - Hexenone, 1 - bromo-3 - (1 - piperidylmethyl)-, -HBr, 1812⁸.
- Spiro[piperidine - 1,1' - pyrrolidine] - 3'-one, 4' - allyl - *N* - bromo-, 1812⁸.
- C₁₂H₁₁BrP Triethylphenylphosphonium bromide, 66⁴.
- C₁₂H₁₁Br₂N₂O₂ 2,5 - Piperazinedione, 1,4 - dibromo - 3,6 - diisobutyl-, 3892⁸.
- C₁₂H₁₁IN Ethyldimethylphenethylammonium iodide, 2660⁴.
- C₁₂H₁₁N₂ *m* - Phenylenediamine, *N* - butyl-4,6-dimethyl-, 2670⁸.
- C₁₂H₁₁N₂O₂ Barbituric acid, ethylhexyl-, P 1871⁴.
- C₁₂H₁₁N₂O₂ Compd., m. 171°, from 2,3-dimethylpyrrole, 243⁷.
- C₁₂H₁₁N₂O₂ 1,4 - Piperazinedicarboxamide, *N,N'*-diallyldithio-, 1799¹.
- C₁₂H₁₀O Δ^1 - Bicyclo[1.2.2]heptene, 2 - ethoxy-1,3,3-trimethyl-, 1808¹.
- Cyclohexanone, 2 - cyclohexyl-, 2667⁸.
- Isopulegone, 2-ethyl-, 1103¹.
- 2(1) - Naphthalenone, octahydro - 4a,8-dimethyl-, 2889².
- C₁₂H₁₀OS₂ 5 - Carylaxanthic acid, Me ester, 3192².
- C₁₂H₁₀O₂ Δ^1 - Cyclohexeneacetic acid, α - ethyl-, Et ester, 3187¹.
- Epiborneol, acetate, 1109⁴.
- Furan, 2 - (heptyloxymethyl)-, 1648⁸.
- Geraniol, acetate, 1407⁸.
- Homocamphenilol, acetate, 2891⁴.
- Linalol acetate, 984¹, 3707⁸.
- C₁₂H₁₀O₂ Δ^1 - Cyclohexenecarboxylic acid, 6- α - hydroxyamyl-, and *Ag salt*, 2261⁷.
- 1 - Naphthaleneacetic acid, decahydro - 1-hydroxy-, 1113⁷.
- C₁₂H₁₀O₄ 1,2 - Cyclobutanedicarboxylic acid, 3,4 - dimethyl-, di-Et ester, 3603⁸.
- C₁₂H₁₀O₅ Glucose, diacetone-3-thio-, 1634⁴.
- C₁₂H₁₀O₅ Fructose, diacetone-, 1798².
- Galactose, diacetone-, 1798².
- Glucose, diacetone-, 63², 1798², 3891⁴.
- Propionin, 1478⁷.
- C₁₂H₁₀O₇ Helvellic acid, 2037⁷.
- C₁₂H₁₀O₁₀ Biosan, 174².
- Dihexosan, 1472⁸.
- C₁₂H₁₀O₁₂ Aldobionic acid, 3646^{1,3}.
- Sol. specific substance of pneumococcus, 2288¹.
- C₁₂H₁₁BrNO 2 - Hexanone, 5,6 - dibromo - 3-(1 - piperidylmethyl)-, -HBr, 1812⁸.
- Spiro[piperidine - 1,1' - pyrrolidine], 4'-acetyl - *N* - bromo - 2' - (bromomethyl)-, 1812⁸.
- C₁₂H₁₁Br₂NO₂ 4 - Acetyl - 2 - (bromomethyl)-4 - carboxy - 1,1 - dimethylpyrrolidinium bromide, Et ester, 1812⁸.
- C₁₂H₁₁N₂ Dodecenonitrile, 895⁸, 2873².
- C₁₂H₁₁NO Acetamide, *N* - (decahydro - 2 - naphthyl)-, 1112⁸.
- Acetimide acid, bornyl ester, and -HCl, 388².
- Δ^1 - 2 - Hexenone, 4 - (1 - piperidylmethyl)-, and -HBr, 1121⁴.
- C₁₂H₁₁NO₂ Acetohydroxamic acid, bornyl ester, 388².
- Butyric acid, β - (cyclohexylimino)-, ethyl ester, 2870⁷.
- Undecylic acid, κ -cyano-, 1799⁴, 3182⁴.
- C₁₂H₁₁NO₂ Acetamide, *N* - [β - (4 - hydroxycyclohexyl)ethyl]-, acetate, 1805⁴.
- γ - Pentic acid, α - acetyl - α - (dimethylaminomethyl)-, Et ester, and -HBr, 1812⁸.
- C₁₂H₁₁NO₂S Isoamylsulfuric acid, toluidine salt, 53¹.
- C₁₂H₁₁N₂O Cyclopentanone, 2 - ethyl - 2 - isopropenyl - 5 - methyl-, semicarbazone, 1103¹.
- Isopulegone, 2 - methyl-, semicarbazone, 1103¹.
- C₁₂H₁₁N₂O₂ 1,3,5,2 - Oxadiazine - 2 - acetic acid, 2 - ethyltetrahydro - 4 - keto - 3,5 - dimethyl - 6 - methylimino-, Et ester, 2132¹.
- C₁₂H₁₁O₄P Glucosephosphoric acid, acetone-, *Ba salt*, 924².
- C₁₂H₁₁ Bicyclohexyl, 900⁸.
- Bicyclopentyl, 3,3' - dimethyl-, 900⁸.
- Cyclohexane, 1,1 - dimethyl - 3 - methylene-2-propyl-, 738¹.
- , 2 - isopropyl - 1,1 - dimethyl - 3 - methylene-, 738¹.
- 2,6 - Decadiene, 2,6 - dimethyl-, 50⁷.
- Hydrocarbon, b. 215-0°, from 3 - methylcyclopentanone, 900⁸.
- Naphthalene, decahydromethyl-, 900⁸.
- C₁₂H₁₁BeCl₂ Addn. compd. from isohexonitrile and BeCl₂, 160¹⁸.
- C₁₂H₁₁BrN Lauronitrile, α -bromo-, 3349⁷.
- C₁₂H₁₁BrNO₂ Norleucine, *N* - (α - bromoisocaproyl)-, 1966¹.
- C₁₂H₁₁ClN Fencholimidyl chloride, *N*-ethyl-, 1446².
- C₁₂H₁₁N₂O Δ^1 - 2 - Hexenone, 4 - (1 - piperidylmethyl)-, oxime, -HCl, 1121⁴.
- C₁₂H₁₁N₂O₂ 2,5 - Piperazinedione, 3 - butyl - 6 - isobutyl-, 1966¹.
- 2(1) - Pyrimidone, 4,6 - epoxy - 4,5,5,6-tetraethyltetrahydro-(?), 3351⁸.
- C₁₂H₁₁N₂O₂ Allophanic acid, menthyl ester, 400⁴, 1806⁴.
- C₁₂H₁₁N₂O₄ 1,2 - Cyclohexanedicarbamlic acid, di-Et ester, 590⁸.
- C₁₂H₁₁N₂O₅ Cystine, *N,N'* - dialanyl-, 57⁸, 3071¹.
- C₁₂H₁₀O Alc., b. 124-6°, from 3 - methylcyclopentanone, 900⁸.
- Cyclohexanol, 2 - cyclohexyl-, 375⁴.
- Cyclohexanone, 3 - isoamyl - 4 - methyl-, 578⁸.
- Cyclopentaneacetaldehyde, 3-isoamyl-, 399¹.
- Endoborneol, Et ether, 3612⁸.
- Isobenzofuran, 1,2,2a,3,4,5,6,6a - octahydro - 1,1,2,2 - tetramethyl-, 590⁸.

- Ketone, b. n 127-8°, from tetrahydroclemene, 578¹.
- C₁₂H₂₂O₂ Δ⁸-1-Decenol, acetate, 3350¹.
- Dodecenoic acid, 895⁶; and *Ba salt*, 2873^{2,4}.
- Ketone, 5 - hydroxy - 2,2,3,3,5 - pentamethylcyclopentyl methyl, 1970¹.
- Lauric acid, γ - hydroxy-, lactone, 2873².
- Menthol, acetate, 400⁸.
- C₁₂H₂₂O₂ Capric acid, *i*-formyl-, Me ester, 895⁶.
- C₁₂H₂₂O₄ Adipic acid, α,γ - dimethyl-, di-Et ester, 230⁶.
- 6 Capric acid, *i*-hydroxy-, acetate, 894⁴.
- 1,10 - Decanedicarboxylic acid, 390⁶, 3182⁵.
- Malonic acid, α - propylbutyl-, mono Et ester, 3187⁷.
- 1,9 - Nonanedicarboxylic acid, methyl-, 3349⁴, 3350¹.
- Sebacic acid, dimethyl ester, 1216⁹.
- C₁₂H₂₂O₆ Glucose, acetone - 3,5,6 - trimethyl-, 63⁴.
- C₁₂H₂₂O₉ Hydrocellulobial, 2598³.
- C₁₂H₂₂O₁₀S₂ Disulfide, diglucosyl, 1634⁴.
- C₁₂H₂₂O₁₁ (See also *Gentobiose*; *Isomaltose*; *Lactose*; *Maltose*; *Melibiose*; *Sucrose*; *Turanose*.)
- Amylobiose, 1472⁴.
- Galactose, 6-glucosido-, 1634⁴.
- d*-Glucose, galactosido-, 225⁶, 1794⁵, 2122¹.
- Isocellulobiose, 3456².
- Trehalose, 2421¹, 2598³.
- C₁₂H₂₂O₁₂ Lactobionic acid, 1969⁸.
- Maltobionic acid, 1969⁸; *Cu salt*, 1967².
- C₁₂H₂₂BrO₂ Undecylic acid, α bromo-, Me ester, 3349⁴.
- C₁₂H₂₂N Dicyclohexylamine, *-HBr*, 1800¹.
- Quinoline, decahydrotrimethyl-, 2696⁴.
- C₁₂H₂₂NO Acetamide, *N*-menthyl-, 791^{3,7}.
- Δ⁵ - 2 - Hexenol, 4 - (1 - piperidylmethyl), 1121⁴.
- C₁₂H₂₂NO₂ Butyric acid, β - (cyclohexylamino)-, ethyl ester, and *-HCl*, 2876⁷.
- C₁₂H₂₂NO₃ Sebacic acid, ethyl ester, 258⁸.
- Valeric acid, α - acetyl-α - propyl-, Et ester, oxime, 3347⁴.
- C₁₂H₂₂NO₁₁ Melibiose, oxime, 2121⁸.
- C₁₂H₂₂N₂O₁ Undecylic acid, *α*-keto-γ semicarbazone, 3348⁵.
- C₁₂H₂₂O₁₁P Sucrosephosphoric acid, 2480⁴.
- C₁₂H₂₁Au₂Cl₂S₆, 3495⁹.
- C₁₂H₂₁Au₂S₁₂, 3496¹.
- C₁₂H₂₁Au₂Cl₂S₆, 3495⁹.
- C₁₂H₂₁Br₂ Hendecane, 1,11 - dibromo - 3-methyl-, 3350¹.
- C₁₂H₂₁ClNaO₁₂ + 11H₂O Compd. of glucose and NaCl, 1743³.
- C₁₂H₂₁INO₂ (Carboxycyclopentylmethyl)trimethylammonium iodide, Et ester, 59⁴.
- C₁₂H₂₁I,N₃S₂, 213⁸.
- C₁₂H₂₁N₂O₃ Norleucine, *N*-leucyl-, 1966¹.
- C₁₂H₂₁N₂O₄ Decanedicarboxylic acid, diamino-, 2459⁸.
- C₁₂H₂₁N₂O₂ Valeric anhydride, γ,γ' - diamino-γ,γ' - dihydroxy - α,α' - dimethyl ('), 244².
- C₁₂H₂₄O 1-Dodecanol, 2873^{2,4}.
- Lauraldehyde, 2530⁴.
- Nonanol, cyclopropyl-, 2666⁵.
- C₁₂H₂₄O₂ (See also *Lauric acid*.)
- Acetic acid, decyl ester, 2658⁸.
- 1,2 - Cyclohexanedicarbinol, α,α,α',α'-tetramethyl-, 590⁶.
- C₁₂H₂₄O₂S Lauric acid, α-mercapto-, 3045⁹.
- C₁₂H₂₄O₃ Lauric acid, γ-hydroxy-, 2873⁴.
- C₁₂H₂₄BrO 1-Dodecanol, 12-bromo-, 3349⁴.
- C₁₂H₂₄N Piperidine, 5-butyl-2-propyl-, 2130⁴.
- C₁₂H₂₄NO 2 - Pentanone, 3 - dipropylaminomethyl-, and *chloraurate*, 1121⁴.
- C₁₂H₂₄N₂O₂ 2 - Pentanone, 4 - isomoxo - 4-methyl-, semicarbazone, 892⁷.
- C₁₂H₂₄CrN₂S₄, 1587⁴.
- C₁₂H₂₄INO₂ (α - Carboxyethyl)methyldipropylammonium iodide, Et ester, 60⁴.
- C₁₂H₂₄N₂ 1,6 - Hexanediamine, *N* - Δ⁴ - hexenyl-, and *salts*, 3186^{4,8}.
- C₁₂H₂₄N₂O Isocaproamide, α - butylamino-*N*-ethyl-, and *-HCl*, 1657⁹.
- , α - diethylamino - *N* - ethyl-, 1657⁹.
- 2 - Pentanone, 3 - dipropylaminomethyl-, oxime, *-HCl*, 1121⁴.
- Propionamide, α - butylamino - *N* - isomyl-, and *-HCl*, 1657⁹.
- C₁₂H₂₄N₂O₁₁V₂ Ammonium vanadium citrate, 1235⁹.
- C₁₂H₂₄N₂O₁₁V₂ Ammonium vanadylcitrate, 542³.
- C₁₂H₂₄O Ether, decyl ethyl, 2658⁴.
- C₁₂H₂₄O₂ 1,11 - Hendecanediol, 3 - methyl-, 3350¹.
- C₁₂H₂₄O₂Pb Triethyllead caproate, 1445⁹.
- C₁₂H₂₄O₂S₂ Rhamnose, di-Pr mercaptal, 64⁸.
- C₁₂H₂₄O₂S₂ Galactose, di-Pr mercaptal, 64⁸.
- d*-Glucose, di-Pr mercaptal, 64⁸.
- Mannose, di-Pr mercaptal, 64⁸.
- C₁₂H₂₄AlO₆ Ethanol, 2-ethoxy, Al deriv., P 1660⁹.
- C₁₂H₂₄N Isoamylamine, *N,N* - diethyl - α-isobutyl-, 3346².
- Tributylamine, 2659⁹.
- Triisobutylamine, 2659⁹.
- C₁₂H₂₄NO 1 - Hexanol, 2 - (α - aminoethyl) - 2-butyl-, and *salts*, 3347⁸.
- C₁₂H₂₄IN Tetrapropylammonium iodide, 891⁴.
- C₁₂H₂₄N₄ Piperazine, 1,4 - bis-(δ - aminobutyl)-, and *(dila HCl)*, 566⁹.
- C₁₂H₂₄CdO₄S₄ + 10H₂O Cadmium triethylsulfonium sulfate, 2623¹.
- C₁₂H₂₄CoO₄S₄ + 10H₂O Cobalt triethylsulfonium sulfate, 2623¹.
- C₁₂H₂₄FeO₄S₄ + 10H₂O Iron triethylsulfonium sulfate, 2622².
- C₁₂H₂₄MgO₄S₄ + 11H₂O Magnesium triethylsulfonium sulfate, 2623¹.
- C₁₂H₂₄MnO₄S₄ + 11H₂O Manganese triethylsulfonium sulfate, 2623¹.
- C₁₂H₂₄N₂ Spermine, dimethyl-, and *chloraurate*, 1964⁴.
- C₁₂H₂₄N₂NiO₄ + 4H₂O Tetramethylammonium nickel biuret, 866⁹.
- C₁₂H₂₄N₂O₁₂S₄ + 11H₂O Nickel triethylsulfonium sulfate, 2623¹.
- C₁₂H₂₄O₄S₂ Triethylsulfonium sulfate, 2622².
- C₁₂H₂₄O₃Zn + 10H₂O Zinc triethylsulfonium sulfate, 2623¹.
- C₁₂H₂₄Cr₂N₂O₁₄, 1601¹.
- C₁₂H₂₄B₂CoF₂N₂O₈, 1235⁴.
- C₁₂H₂₄B₂MgN₂O₈, 1235⁴.
- C₁₂H₂₄B₂F₂MnN₂O₈, 1235⁴.
- C₁₂H₂₄B₂F₂N₂NiO₈, 1235⁴.
- C₁₂H₂₄FeCl₂N₂ Propylammonium heptachloroferrate, 711⁷.
- C₁₂H₂₄Cu₂I₂N₂ Tetraatriaminopropanetricupric hexaiodide, 388⁹.
- C₁₂H₂₄Co₂N₂O₈S₂, 2442⁴.
- C₁₂N₂F₂Yt₂ + 21H₂O Yttrium cyanoplatinite, 1772⁴.

- C₁₃H₈Br₂ClO₂** Phenol, 3,5 - dibromo - 2,4,6-trichloro-, benzoate, 574^{1,4}.
C₁₃H₈Br₂ClO₂ Phenol, tribromodichloro-, benzoate, 574^{1,4}.
C₁₃H₈Br₄ClO₂ Phenol, tetrabromochloro-, benzoate, 574^{1,4}.
C₁₃H₈Cl₂NO₂S 5,6 - Benzothiazole-dione, 3,4-dichloro-1-phenyl-, 2692¹.
C₁₃H₈Cl₄NO₂S 5,6 - Benzothiazole-dione, 3,3,4,4-tetrachloro - 3,4 - dihydro - 1 - phenyl-, 2692¹.
C₁₃H₈Cl₄NO₂S 5(4) - Benzothiazolone, 3,3,4,4,6,6 - hexachloro - 3,6 - dihydro - 1 - phenyl-, 2692¹.
C₁₃H₈BrCl₃O₂ Phenol, 3 - bromo - 2,4,6 - trichloro-, benzoate, 3606¹.
C₁₃H₈BrNO₂ 9 - Fluorenone, 2 - bromo - 7-nitro-, 1643¹.
C₁₃H₈Br₃ClO₂ Phenol, 3,4,6 - tribromo - 2-chloro-, benzoate, 3606¹.
C₁₃H₈ClNO₂ 9 - Fluorenone, 2-chloro - 7-nitro-, 3616¹.
C₁₃H₈Cl₂N₂O₂ 4,5 - Benzimidazole-dione, 6,7-dichloro-2-phenyl-, 2692¹.
C₁₃H₈Cl₂N₂O 5(4) - Pyrazo[5,4 α]phenazinone, 4,4-dichloro-, 2693¹.
C₁₃H₈Cl₂NO₂S 5 - Benzothiazolol, 3,4,6 - trichloro - 1 - phenyl-, 2692¹.
C₁₃H₈Cl₂N₂O 7 - Triazirindiazeneone, 1 - (2,4,6-trichlorophenyl)-, 1638¹.
C₁₃H₈Cl₂N₂O 5(4) - Benzimidazolone, 4,4,6,7-tetrachloro-2-phenyl-, 2692¹.
C₁₃H₈Cl₂N₂S Carbanilide, hexachlorothio-, 904¹.
C₁₃H₈N₂O₂S 8 - Acenaphthoxidiazine, 8 - thio-, 3190¹.
C₁₃H₈N₂O 9 - Fluorenone, 2,5 - dinitro-, 2387¹.
C₁₃H₈N₂O₂ Carbanilide, 2,4,6,2',4',6' - hexanitro-, 673¹.
C₁₃H₈BrClNO₂S 5 - Benzothiazolol, 4(and 6)-bromo - 6(and 4) - chloro - 1 - phenyl-, 2692^{1,3}.
C₁₃H₈BrN₂O₂ 5(10) - Acridone, 2 - bromo - 8-nitro-, 3905¹.
C₁₃H₈BrN₂O₂S 9-Fluorenone, 2-bromo 7 nitro-, oxime, 1643¹.
C₁₃H₈BrN₂O₂S 5 - Benzothiazolol, 4 - bromo-6-nitro-, 2692¹.
C₁₃H₈Br₂O 9-Fluorenone, 2-bromo-, 1643¹.
C₁₃H₈Br₂NO₂S 4 - Benzisothiazolol, 3,5 - dibromo-2-phenyl-, 2693¹.
C₁₃H₈Br₂NO₂S 5 - Benzothiazolol, 4,6 - dibromo - 1 - phenyl-, 2692¹.
C₁₃H₈Br₂N₂O 1,2,3 - Benzotriaz - 4(3) - one, 3 - (2,4 - dibromophenyl)-, 1638¹.
C₁₃H₈Br₂N₂O 7 - Triazirindiazeneone, 1 - (2,4 - dibromophenyl)-, 1638¹.
C₁₃H₈Br₃O₂ Phenol, 2,4,5 - tribromo-, benzoate, 3606¹.
C₁₃H₈BrClNO₂ 5(10) - Acridone, 2 - chloro - 8-nitro-, 3905¹.
C₁₃H₈BrClNO₂S 5 - Benzothiazolol, 4(and 6)-chloro-6(and 4)-nitro-, 2692^{1,3}.
C₁₃H₈Cl₂NO₂S 4 - Benzisothiazolol, 3,5 - dichloro-2-phenyl-, 2693¹.
C₁₃H₈Cl₂NO₂S 5 - Benzothiazolol, 4,6 - dichloro - 1 - phenyl-, 2692¹.
C₁₃H₈Cl₂NO₂S 5,6 - Benzothiazole-diol, 3,4-dichloro-1-phenyl-, 2692¹.
C₁₃H₈Cl₂N₂O 7 - Triazirindiazeneone, 1 - (2,4-dichlorophenyl)-, 1638¹.
C₁₃H₈Cl₂N₂O₂ 2,1,3 - Benzotriazole - 4,5 - dione, 6,7 - dichloro - 2 - *p*-tolyl-, 2689¹.
C₁₃H₈IO 9 - Fluorenone, 2 - iodo-, 1643¹, 3360¹.
C₁₃H₈N₂O₂ Glycine, (α - keto - β - methylbutyryl)-, phenylhydrazone, 3892¹.
C₁₃H₈BrCl Fluorene, 2 - bromo - 9 - chloro-, 1643¹.
C₁₃H₈BrNO 9-Fluorenone, 2-amino-7-bromo-, 1643¹.
C₁₃H₈BrNO₂S 4 - Benzisothiazolol, 3 - bromo - 2-phenyl-, 2693¹.
C₁₃H₈BrNO₂S 5 - Benzothiazolol, 4 - bromo - 1 - phenyl-, and -II Br, 2692¹.
C₁₃H₈BrNO₂S Fluorene, bromonitro-, 1643^{1,3}, 1810¹.
C₁₃H₈BrNO₂S 3 - Pyranoquinolone, 2 - bromo - 8 - methyl-, and salts, 3827^{1,8}.
C₁₃H₈BrNO₂S Benzenesulfenyl bromide, 2-benzoyl - 4 - nitro-, 2693¹.
C₁₃H₈BrN₂O 1,2,3 - Benzotriaz - 4(3) - one, 3 - (*p* - bromophenyl)-, 1638¹.
C₁₃H₈BrN₂O 7 - Triazirindiazeneone, 1 - (*p* - bromophenyl)-, 1638¹.
C₁₃H₈BrN₂S Carbanilide, 2,5,2',5' - tetra-bromothio-, 1637¹.
C₁₃H₈ClNO 9 - Fluorenone, 2 - amino - 7 - chloro-, 3616¹.
C₁₃H₈ClNO₂S 4 - Benzisothiazolol, 3 - chloro - 2-phenyl-, 2693¹.
C₁₃H₈ClNO₂S 5 - Benzothiazolol, 4(and 6) - chloro - 1-phenyl-, 2692^{1,3}.
C₁₃H₈ClNO₂S Fluorene, 2 - chloro - 7 - nitro-, 3616¹.
C₁₃H₈ClNO₂S Picolinic acid, 3 - (α - chloro - α - hydroxybenzyl)-, lactone, -HCl, 1651¹.
C₁₃H₈ClNO₂S Picolinyl chloride, 3 - benzoyl-, 1651¹.
C₁₃H₈ClN₂O₂ 4(7) - Benzimidazolone, 6 - chloro-5 - hydroxy - 7 - phenylimino-, 2691¹.
C₁₃H₈ClN₂O₂ 7(4) - Isoindazolone, 5 - chloro - 6 - hydroxy-4-phenylimino-, 2693¹.
C₁₃H₈ClN₂O 7 Benzaldehyde, 2(4 and 6)-chloro-3 - hydroxy - 4,6(2,6 and 2,4) - dinitro-, *p* - nitrophenylhydrazone, 3777^{1,8}.
C₁₃H₈ClN₂O 5 - Benzimidazolol, 4,6 - dichloro-2-phenyl-, 2692¹.
C₁₃H₈ClN₂O Methane, bis(4 - chloro - 3-nitrophenyl)-, 2681¹.
C₁₃H₈ClN₂O₂ Benzaldehyde, 2,4(and 2,6)-dichloro - 3 - hydroxy - 6(and 4) - nitro-, *p*-nitrophenylhydrazone, 3777^{1,8}.
C₁₃H₈ClNO 9-Fluorenone, 2,7 - dichloro-, 3616¹.
C₁₃H₈ClNO₂ Carbanilide, 2,4,6-trichloro-, 3190¹.
C₁₃H₈Cl₂N₂O 2,1,3 - Benzotriazol - 5 - ol, 4,6,7-trichloro-2-*p*-tolyl-, 2689¹.
C₁₃H₈Cl₂N₂S Carbanilide, 2,3,2',3' - tetra-chloro-, 904¹.
C₁₃H₈Cl₂N₂O 2,1,3 - Benzotriazol - 5(4) - one, 4,4,6,7,7 - pentachloro - 6,7 - dihydro-2-*p*-tolyl-, 2689¹.
C₁₃H₈INO 9-Fluorenone, 2-iodo-, oxime, 3361¹.
C₁₃H₈INO₂ Fluorene, 2-iodo-7-nitro-, 3361¹.
C₁₃H₈INO₂ Phenol, iodonitro-, benzoate, 1974¹.
C₁₃H₈INO₂S 1 - Acridinesulfonic acid, 4 - hydroxy-3-iodo-, 1461¹.
C₁₃H₈N₂O₂ Acridine, nitro-, 1815¹, 2903¹.
C₁₃H₈N₂O₂S Benzisothiazolol, 4-nitro-2-phenyl-, 2693¹.
C₁₃H₈N₂O₂Se Benzoselenazole, 1 - (nitrophenyl)-, 3055¹.
C₁₃H₈N₂O₂ 7,8 - Benzoquinoline - 2,4(1,3)-dione, 1-nitroso-, 1987¹.
C₁₃H₈N₂O₂ 9 - Fluorenone, 5 - amino - 2 - nitro-, 1987¹.
C₁₃H₈N₂O₂ 2-nitro-, oxime, 3904¹.
C₁₃H₈N₂O₂ 9(10) - Phenanthridone, nitro-, 1987^{1,8}, 3904¹.
C₁₃H₈N₂O₂S 4 - Benzisothiazolol, 3 - nitro - 2-phenyl-, 2693¹.
C₁₃H₈N₂O₂S 5 - Benzothiazolol, nitrophenyl-, 2692¹.
C₁₃H₈N₂O₂ Fluorene, dinitro-, 2387¹.

- C₁₃H₉N₄**, Acenaphthotriazine, 9-amino-, 3201².
C₁₃H₇N₃O₃S Carbanilide, 3,5,3',5'-tetranitrothio-, 1637⁹.
C₁₃H₇N₃O₃ Carbanilide, 2,4,2',4'-tetranitro-, 674.
C₁₃H₇O₂, 1,3-Benzodithiole, 2-(4-keto-*p*-phenylidene)-, and *HCl*, 1985¹.
C₁₃H₇O₂ Acenaphthenequinone, 1-methyl-, 1645².
 6-Dibenzopyrone, 2266⁴.
 Xanthone, 58¹, 408², 1121¹, 3904⁴.
C₁₃H₇O₃ Xanthone, 3-hydroxy-, 238⁴.
C₁₃H₇O₄ 1,2- β -Naphthofurandione, 7-methoxy-, 1646¹.
 Xanthone, dihydroxy-, 238⁴.
C₁₃H₇AsClNO₂ Phenarsazinecarboxylic acid, 1-chloro-1,6-dihydro-, 1252².
C₁₃H₇AsO₂ Benzoic acid, *o*-phenylarsino-, cyclic anhydride, 738⁹.
C₁₃H₇Br Fluorene, 2-bromo-, 1643², 1810⁴.
C₁₃H₇BrClNO₂ Benzaldehyde, bromochloro-, *p*-nitrophenylhydrazone, 1254².
C₁₃H₇BrINO₂ 3-Pyranquinolone, 2-bromo-, methiodide, 382².
C₁₃H₇BrIN₂O₂ Benzaldehyde, bromiodo-, *p*-nitrophenylhydrazone, 1254².
C₁₃H₇BrN₂O₂ Benzaldehyde, 4-bromo-3-nitro-, *p*-nitrophenylhydrazone, 1254².
C₁₃H₇BrO 9-Fluorenol, 2-bromo-, 1643².
C₁₃H₇BrO₂ 2-Indancarboxylic acid, 2-(γ -bromo- β -hydroxypropyl)-1,3-diketo-, lactone, 3203¹.
C₁₃H₇BrN₂O₂ Benzaldehyde, 3,4-dibromo-, *p*-nitrophenylhydrazone, 1254².
 Benzoic acid, *o*-(2,4-dibromophenyltriazeno)-, and isomer, 1638⁹.
C₁₃H₇BrN₂O₂ Benzoic acid, *o*-nitro-, 2,4-dibromophenylhydrazide, 1638⁹.
C₁₃H₇BrN₂ Pentazine, 4-(2,4-dibromophenyl)-1,4-dihydro-6-phenyl-, 914².
 1,2,3,4-Tetrazole, 1-(2,4-dibromoanilino)-5-phenyl-, 914².
C₁₃H₇Cl Fluorene, 2-chloro-, 1810⁴, 3616⁷.
C₁₃H₇ClIN₂O₂ Benzaldehyde, chloriodo-, *p*-nitrophenylhydrazone, 1254².
C₁₃H₇ClNO₂ 5-Benzimidazolol, 4-chloro-1-phenyl-, 2601².
C₁₃H₇ClNO₂ Benzaldehyde, 4-chloro-3-nitro-, *p*-nitrophenylhydrazone, 1254².
C₁₃H₇ClNO₂ Benzaldehyde, chloro-3-hydroxynitro-, *p*-nitrophenylhydrazone, 377¹, 55².
C₁₃H₇ClO Benzoyl chloride, *p*-phenyl-, 1455⁴.
 9-Fluorenol, 2-chloro-, 3616⁷.
C₁₃H₇Cl₂NO Benzimidyl chloride, chlorophenyl-, 3190², 54⁴.
o-Cresol, α -[2,4-(and 3,4)-dichlorophenylimino]-, 3621¹.
C₁₃H₇Cl₂N₂O₂ Benzaldehyde, 3,4-dichloro-, *p*-nitrophenylhydrazone, 1254².
 Benzoic acid, *o*-(2,4-dichlorophenyltriazeno)-, and isomer, 1638⁹.
 2,1,3-Benzotriazole-4,5-diol, 6,7-dichloro-2-*p*-tolyl-, 2689².
C₁₃H₇I Fluorene, iodo-, 239², 1643², 3360⁷.
C₁₃H₇IN₂O₂ Benzaldehyde, 4-iodo-3-nitro-, *p*-nitrophenylhydrazone, 1254².
C₁₃H₇IO₂ Resorcinol, 4-iodo-, benzoate, 2671⁴.
C₁₃H₇IN₂O₂ Benzaldehyde, 3,4-diiodo-, *p*-nitrophenylhydrazone, 1254².
C₁₃H₇N See *Acridine*.
C₁₃H₇NO 4-Acridol, and salts, 1461⁷.
C₁₃H₇NO₂ 4-Benzisothiazolol, 2-phenyl-, 2693².
 5-Benzisothiazolol, 1-phenyl-, 2692².
C₁₃H₇NO₂S Benzoselenazole, 1-(*o*-nitrophenyl)-, 3055¹.
C₁₃H₇NO₂ 5(10)-Acridone, 4-hydroxy-, 1461⁷.
 7,8-Benzoquinoline-2,4-diol, 1987².
 Fluorene, 2-nitro-, 3362¹.
 1-Naphthonitrile, 2-hydroxy-, acetate, 3363².
 3-Pyranquinolone, 8-methyl-, and salts, 411¹, 3.
C₁₃H₇NO₂ 2-Furo[3,2-*f*]quinolinecarboxylic acid, 7-methyl-, and *Ag* salt, 382².
C₁₃H₇NO₂S Benzophenone, 2-mercapto-5-nitro-, 2693¹.
C₁₃H₇NO₂ Pyridinedicarboxylic acid, phenyl-, 382².
C₁₃H₇NO₂S 1-Acridinesulfonic acid, 4-hydroxy-, 1461⁷.
C₁₃H₇N₂S Benzisothiazole, 2-phenyl-, 2693².
C₁₃H₇N₂O₂S Benzisothiazole, 4-amino-3-nitro-2-phenyl-, 2693⁴.
C₁₃H₇N₂O₂S 2-Phenyl-4-benzisothiazole-diazonium sulfate, 2693².
C₁₃H₇N₂O₂ Anthranilic acid, 5-nitro-*N*-(*o*-nitrophenyl)-, 232².
C₁₃H₇N₂O₂ Ether, 2,4-dinitrobenzyl *p*-nitrophenyl-, 2458¹.
C₁₃H₇N₂S Benzothiadiazole, 4-benzalamino-, 2690².
C₁₃H₇N₂O₂S Benzisothiazole, 4-amino-3-(*p*-nitrophenylazo)-, 2693¹.
C₁₃H₇N₂O₂ Diphenylamine, 3-(methylnitramino)-2,4,6,3'-tetranitro-, 2672².
C₁₃H₇ See *Fluorene*.
C₁₃H₇AgN₂O Triazene, 3-benzoyl-1-phenyl-, silver deriv., 2003².
C₁₃H₇AsNO₂Se 1-Benzoselenazole-*p*-benzenearsonic acid, and *Na* salt, 3055¹.
C₁₃H₇BrN₂ 2-Fluorylamine, 7-bromo-, 1643².
C₁₃H₇BrNO 9-Fluorenol, 2-amino-7-bromo-, 1643².
C₁₃H₇BrN₂ Benzimidazole, 5-amino-4-bromo-2-phenyl-, 2691⁴.
C₁₃H₇BrN₂S Carbanilide, *o,o'*-dibromothio-, 1637⁹.
C₁₃H₇ClN₂ 2-Fluorylamine, 7-chloro-, 3616⁷.
C₁₃H₇ClNO *o*-Cresol, α -(*m*-chlorophenylimino)-, 3621¹.
 9-Fluorenol, 2-amino-7-chloro-, 3616⁷.
C₁₃H₇ClNO₂S Disulfide, 4-chloro-2-nitrophenyl *p*-tolylsulfonfyl, 2885².
C₁₃H₇ClN₂ Benzimidazole, 5-amino-4-chloro-1-phenyl-, 2691⁴.
C₁₃H₇ClNO₂ Benzaldehyde, 2-chloro-4-hydroxy-, *p*-nitrophenylhydrazone, 3189².
 Salicylaldehyde, 4-chloro-, *p*-nitrophenylhydrazone, 3189².
C₁₃H₇ClN₂O₂ Diphenylamine, 5-chloro-4'-methyl-2,4-dinitro-, 2691⁴.
C₁₃H₇ClN₂S Carbanilide, dichlorothio-, 67¹, 671⁷.
C₁₃H₇Cl₂O₂S Disulfide, 2,5-dichlorophenyl *p*-tolylsulfonfyl, 2885².
C₁₃H₇Cl₂O₂ Benzoic acid, 3-(β -dichloro- α -hydroxyvinyl)-4-hydroxy-, diacetate, 1980².
C₁₃H₇Cl₂O₂ 1,3-Benzodioxan-6-carboxylic acid, 2,4-bis(trichloromethyl)-, Et ester, 1980².
C₁₃H₇FNO₂S Benzenesulfonfyl fluoride, *m*-phenylcarbamyl-, 3604².

- C₁₂H₁₁FN₃O₂** Benzaldehyde, fluoro-, *p*-nitrophenylhydrazone, 238⁴.
- C₁₂H₁₁N₃S** Carbanilide, *o,o'*- diiodothio-, 1637².
- C₁₂H₁₁N₂** Acridine, 1-amino-, 2903³.
1,4-Imidazopyridine, 2-phenyl-, 240⁶.
Methane, bis(phenylimino)-, 584³.
Phenazine, 2-methyl-, 1815⁴.
- C₁₂H₁₁N₃O** 5-Benzimidazolol, 1-phenyl-, 2691¹.
2,3,7,8-Dibenzo-1,5,6-octaoxydiazine, 2133².
- C₁₂H₁₁N₂O₂S** 5-Benzothiazolol, 6-amino-, 2692².
- C₁₂H₁₁N₂O₂** Aniline, *N*-nitrobenzal-, 2669⁴.
- C₁₂H₁₁N₂O₂S** Benzisosulfonazole, 1,2-dihydro-2-(phenylsulfonylimino)-, 2888².
- C₁₂H₁₁N₂O₂** Anisole, 2,6-dinitro-4-phenyl-, 1109⁷.
—, 2-nitro-4-(*p*-nitrophenyl)-, 1109⁷.
Glutaconic anhydride, β -hydroxy- γ -keto-, acetate, phenylhydrazone, 1798³.
- C₁₂H₁₁N₂S** Benzisothiazole, 4-amino-2-phenyl-, 2693².
Benzothiazole, 1-anilino-, 92².
Isothiocyanic acid, β -(*p*-aminophenyl)-phenyl ester, 80⁴.
- C₁₂H₁₁N₂Se** Benzoselenazole, *l*-[*o*(*m* and *p*-aminophenyl)-], 3055¹.
- C₁₂H₁₁N₂** Carbanilonitrile, *p*-phenylazo-(?), 3198¹.
- C₁₂H₁₁N₂O** Indazole, 6-(*p*-hydroxyphenylazo)-, 1120⁴.
1,3,4-Isonaphthotriazine, 2-acetamido-, 3201².
- C₁₂H₁₁N₂O₄** Benzaldehyde, *o*-nitro-, *o*-nitrophenylhydrazone, 2133².
- C₁₂H₁₁N₂O₂S** Carbanilide, *p,p'*-dinitrothio-, 67⁴.
- C₁₂H₁₁N₂O₂** Xenylamine, *N*-methyl-2,6(?)dinitro-*N*-nitroso-, 238¹.
Carbanilide, *m,m'*-dinitro-, 67⁴.
- C₁₂H₁₁N₂O₂** 2-Naphthylamine, *N*-allyl-1,6,8-trinitro-, 404⁴.
- C₁₂H₁₁O** See *Benzophenone*; *Xanthene*.
- C₁₂H₁₁O₂S** 1,3-Benzodithiole, 2-(*p*-hydroxyphenyl)-, and *-HNO₂*, 1985¹.
- C₁₂H₁₁N₂O₂** Benzoic acid, Ph ester, 2430⁴.
Benzophenone, *p*-hydroxy-, 3359⁷.
Salicylaldehyde, 5-phenyl-, 1109⁷.
Xanthidrol, 3904⁵.
- C₁₂H₁₁O₂** (See also *Salol*.)
Naphthofurandione, 1,2-dihydro-1-methyl-, 241⁴.
Naphthoquinone, 2-allyl-3-hydroxy-, 241⁴.
—, allyloxy-, 241⁴.
- C₁₂H₁₁O₄** Benzophenone, 2,4,2'-trihydroxy-, 238¹.
2-Indancarboxylic acid, 2-(β -hydroxypropyl)-1,3-diketo-, lactone, 3203².
Phlorobenzophenone, 1974⁵.
- C₁₂H₁₁O₂** Benzophenone, tetrahydroxy-, 238¹.
1,4-Pyrone, 5-acetyl-2-(2,4-dihydroxyphenyl)-, 1265⁷.
- C₁₂H₁₁O₂** Benzophenone, 2,3,4,2',4'-penta-hydroxy-, 238¹.
- C₁₂H₁₁AsO** Phenoarsine, 6-methyl-, 1653³.
- C₁₂H₁₁AsO₄** Benzoic acid, *o*-phenylarsino-, 738².
- C₁₂H₁₁BrN₃O₂** 3-Pyrazoloquinolone, 2-bromo-7,8,9,10-tetrahydro-8-methyl-7-nitroso-, 362².
- C₁₂H₁₁BrN₃O₇** Benzylamine, *p*-bromo-, picrate, 53².
- C₁₂H₁₁BrN₂O** Anthranilic acid, 2,4-dibromophenylhydrazide, 1638⁴.
- C₁₂H₁₁ClN₂O** Benzenesulfenamide, 4-chloro-*N*-methyl-2-nitro-, 3355⁴.
- C₁₂H₁₁ClN₂O₂** Hydrazobenzene, 5-chloro-*N*-methyl-2,4-dinitro-, 395⁴.
- C₁₂H₁₁ClN₂O₇** Benzylamine, *m*-chloro-, picrate, 54¹.
- C₁₂H₁₁ClO₂** 1,4-Naphthoquinone, 2-(β -chloropropyl)-3-hydroxy-, 241⁴.
- C₁₂H₁₁ClN₂** Guanidine, bis(*p*-chlorophenyl)-, 672⁴.
- C₁₂H₁₁FM** Benzaldehyde, fluoro-, phenylhydrazone, 235⁴.
- C₁₂H₁₁NO₂S** 3-Indolepropionic acid, 2-carboxy-4,6-diiodo-5-methoxy-, 90².
- C₁₂H₁₁N** Aniline, *N*-benzal-, 1652⁴, 2669⁴, 3017⁷; *SnCl₄* addn. compd., 3902¹.
Pyridine, 3-(α -methylenbenzyl)-, 909⁴.
- C₁₂H₁₁NO** Benzanilide, P 2273⁴, 2670¹, 3898².
Benzimidic acid, Ph ester, *-HCl*, 1250⁹.
Benzophenone, oxime, 75², 2681⁴.
- C₁₂H₁₁NO₂** Anisole, nitrophenyl-, 1109⁷.
1-Naphthaldehyde, 2-hydroxy-, acetyl-oxime, 3363³.
5-Quinaldineacrylic acid, 6-hydroxy-, and *Ag salt*, 3197⁷.
5-Quinolineacrylic acid, 6-hydroxy-, Me ester, 3197⁷.
—, 6-hydroxy-8-methyl-, and *Ag salt*, 3197⁴.
- C₁₂H₁₁NO₂S** 2-Benzisosulfonazolol, 1,2-dihydro-2-phenyl-, 3202².
- C₁₂H₁₁NO₂** Acridinic acid, di-Me ester, 2697².
—, mono-Et ester, 2697².
- C₁₂H₁₁NO₂S** Disulfide, *o*-nitrophenyl *p*-tolylsulfonyl-, 2885³.
- C₁₂H₁₁NO₂** Malonic acid, (2-carboxy-3-indylmethyl)-, 583³.
- C₁₂H₁₁N₂O₂Sb** Salicylic acid, 5-(*p*-stibonophenylazo)-, 71⁴.
- C₁₂H₁₁N₂** 2,3,7,8-Dibenzo-1,5,6-octatriazine, 2133².
- C₁₂H₁₁N₂O** Triazene, 3-benzoyl-1-phenyl-, 2903³.
1,2,4-Triazol-5-ol, 3-methyl-1-(1-naphthyl)-, 743³.
- C₁₂H₁₁N₂O₂** *p*-Tolunitrile, α -(4-hydroxy-6-methyl-2-pyrimidylmercapto)-, 3899³.
- C₁₂H₁₁N₂O₂** *p*-Cresol, 2-(*p*-nitrophenylazo)-, 1103⁴.
Salicylaldehyde, *o*-nitrophenylhydrazone 2133².
Xenylamine, *N*-methyl-2-nitro-*N*-nitroso-, 2680³.
- C₁₂H₁₁N₂O₄** Anthranilic acid, *N*-(*p*-amino-phenyl)-5-nitro-, 232².
Guaiacol, 4-(*p*-nitrophenylazo)-, 1251¹.
Phenol, 4-methoxy-2-(*p*-nitrophenylazo)-, 1251¹.
Xenylamine, *N*-methyl-2,6(?)dinitro-, 238¹.
- C₁₂H₁₁N₂S** See *Asure C*.
- C₁₂H₁₁N₂O₂as** Triazino[6,5- β]indole, 3-acet-amido-9-acetyl-, 3201².
- C₁₂H₁₁N₂O₄** Anthranilaldehyde, 2,4-dinitrophenylhydrazone, and *-HCl*, 767².
Benzaldehyde, 4-amino-3-nitro-, *p*-nitrophenylhydrazone, 1254⁴.
Guanidine, bisnitrophenyl-, 672⁴.
- C₁₂H₁₁N₂O₇** Carbamic acid, [2,3,4,5-tetrahydro-3,5-diketo-2-(*p*-nitrophenyl)-6-*as*-triazinylformyl]-, Et ester, 1654⁴.

- C₁₃H₁₁N₅O₉ Benzylamine, nitro-, picrate, 73⁴.
 C₁₃H₁₃ Methane, diphenyl-, 1060⁶, 2266⁷, 3047⁸.
 Naphthalene, 2 - isopropenyl-, 2889¹.
 C₁₃H₁₂AsN Phenarsazine, 1,6 - dihydro - 1 - methyl-, 1654¹.
 C₁₃H₁₂AsNO Anthranilic acid, *N* - (o - arsono-phenyl)-, 1252⁸.
 Benzenearsonic acid, 3 - benzamido - 4 - hydroxy-, P 745².
 Benzoic acid, *m* - (o - arsonoanilino)-, 1252⁸.
 C₁₃H₁₂As₂N₂O₁₁ Arsanic acid, *N*, *N'* - carbonyl-bis[2 - hydroxy - 5 - nitro-, and salts, 2695¹.
 C₁₃H₁₁BrNO₂ 3 - Pyranoquinolone, 2 - bromo-7,8,9,10 - tetrahydro - 8 - methyl-, and salts, 382⁸.
 C₁₃H₁₂BrNO₂ α - Toluenesulfonanilide, *m'* (and *p'*)-bromo-, 99⁴.
 C₁₃H₁₂Br₂N₂S β - Naphthothiazole, 2 - dimethyl-amino-, tetrabromide, 2688⁷.
 —, 2 - ethylamino-, tetrabromide, 584⁷.
 C₁₃H₁₁ClN Benzohydrylamine, *N*-chloro-, 2671³.
 C₁₃H₁₂ClNO₂ α - Toluenesulfonanilide, *o'* (and *p'*)-chloro-, 99⁴.
 C₁₃H₁₂ClNO₂ Ferulic acid, 5-chloro- α -cyano-, Et ester, 906².
 C₁₃H₁₂Cl₂N₂O₄ 5,6 - Benzimidazolediol, 4,7-dichloro - 1,2 - dimethyl-, diacetate, 2601⁷.
 C₁₃H₁₂FNO₂ 1 - Phenol - 4 - sulfonyl fluoride, 2-tolylsulfonyl-, 3605².
 C₁₃H₁₂Hg Phenyl *p*-tolyl mercury, 233⁵.
 C₁₃H₁₂HgO Anisole, *o* - phenylmercuri-, 233⁵.
 C₁₃H₁₂I₂NO Furo[3,2 - b]quinoline, 7 - methyl-, methiodide, 382⁸.
 C₁₃H₁₂N₂ Benzaldehyde, phenylhydrazone, *SnCl*₄ addn. compd., 3902³.
 Fluorenediamine, 238⁸.
 C₁₃H₁₂N₂O Anisole, *p*-phenylazo-, 68⁸.
 Benzoic acid, *p*-phenyl-, hydrazide, 1455⁸.
p-Cresol, 2-phenylazo-, 1103⁸.
 Harmine, 1269⁷.
 C₁₃H₁₂N₂O₂ Carbanilide, *p*-hydroxythio-, 671⁷.
 C₁₃H₁₂N₂O₂ 1,4 - Pyrone, 2,6 - dimethyl - 3-phenylazo-, 3192⁷.
 Xenylamine, *N* - methyl - 2 - nitro-, 2680³.
 C₁₃H₁₂N₂O₂S Carbanilide, *p*, *p'* - dihydroxythio-, 671⁷.
 C₁₃H₁₂N₂O₂ 1 - Imidazoleacetic acid, 4 - benzal-4,5 - dihydro - 5 - keto - 2 - methyl-, *Na* salt, 1813⁸.
 3 - Pyranoquinolone, 7,8,9,10 - tetrahydro-8-methyl-7-nitroso-, 411².
 C₁₃H₁₂N₂O₂S Phenol, *p* - (*p* - tolylsulfonylazo)-, 68⁸.
 C₁₃H₁₂N₂O₂S *p* - Toluenesulfonanilide, 2' - nitro-, 2080².
 C₁₃H₁₂N₂O₂S *m* - Toluenesulfonanilide, 6 - hydroxy-5-nitro-, 3897².
 C₁₃H₁₂N₂S Carbanilide, thio-, 92², 572⁷, 1678⁸; and addn. compds., 67⁸.
 β - Naphthothiazole, 2 - dimethylamino-, 2688⁷.
 —, 2-ethylamino-, 584⁷.
 Urea, diphenylthio-, 671⁷, 1678⁸.
 C₁₃H₁₂N₄O 2,1,3 - Benzotriazole, 5 - amino - 6-methoxy-2-phenyl-, 2689⁸.
 C₁₃H₁₂N₄O₄ Carbamic acid, (2,3,4,5 - tetrahydro - 3,5 - diketo - 2 - phenyl - 6 - *as*-triazinylformyl)-, Et ester, 1654⁴.
 C₁₃H₁₂N₄O₄ 2 - Naphthylamine, *N* - isopropyl-
 * 1,6,8-trinitro-, 404⁶.
 —, 1,6,8 - trinitro - *N* - propyl-, 404⁶.
 C₁₃H₁₂O₂ 2 - Naphthoic acid, thiono-, Et ester, 2458⁸.
 C₁₃H₁₂O₂ Naphthoic acid, dimethyl-, 1045⁸, 1046⁸.
 —, 4-methyl-, Me ester, 582¹.
 C₁₃H₁₂O₂ 3 - Furanicarboxylic acid, 2 - phenyl-, Et ester, 3362⁸.
 1,2 - Naphthoquinone, 4 - isopropoxy-, 84¹.
 C₁₃H₁₂O₄ 1,4 - Naphthoquinone, 2 - hydroxy-3 - (β - hydroxypropyl)-, 241⁶.
 C₁₃H₁₂O₄ Hydroquinone, 2 - (*p* - tolylsulfonyl)-, 68⁸.
 p - Toluenesulfonic acid, *p* - hydroxyphenyl ester, 68⁸.
 C₁₃H₁₂O₄ 1 - Benzofuranmalonic acid, 1,2 - dihydro - 2 - keto - 1,4 - dimethyl-, 911⁷.
 C₁₃H₁₂O₄ Benzaldehyde, 2,4,6 - trihydroxy-, triacetate, 3195¹.
 C₁₃H₁₂O₄ Benzoic acid, trihydroxy-, triacetate, 2329¹.
 C₁₃H₁₂O₄ Gallaldehyde, tris(methyl carbonate), 2886⁶.
 C₁₃H₁₂AsO₆ 6 - Methylphenoxarsonium dihydroxide, 1653⁸.
 C₁₃H₁₂BrO₂ Δ^2 - 2 - Butenone, 4 - (pro-mo-4-hydroxy - *m* - anisyl)-, acetate, 3609⁴.
 C₁₃H₁₂N Benzohydrylamine, 2671³, 2681⁴.
 Diphenylamine, methyl-, P 1273³, 1797³.
 C₁₃H₁₂NO *o* - Cresol, α - amino - α - phenyl-, and salts, 3346⁹.
 Pyridine, 2-*p*-phenetyl-, 585⁷.
 C₁₃H₁₂NO₂ β - Iutenic acid, α - cyano -, Et ester, 228⁶.
 1 - Naphthaldehyde, 2 (and 4) - methoxy-, oxime, Me ether, 3618⁷.
 3 - Pyranoquinolone, 7,8,9,10 - tetrahydro-8-methyl-, and salts, 411².
 3 - Pyrrolecarboxylic acid, 2 - phenyl-, Et ester, 3362⁸.
 Resorcinol, 4 - (*p* - aminobenzyl)-, 3615⁸.
 C₁₃H₁₂NO₂ Cinchoninic acid, 1,2 - dihydro - 2 - keto-1-methyl-, Et ester, 580¹.
 C₁₃H₁₂NO₂ Benzoic acid, *p* - (tetrahydro - 2,5-diketo-1-pyrryl)-, Et ester, 378⁴.
 C₁₃H₁₂N₂O₂S Benzenesulfonic acid, *p* - (4,3-cresyl)-, 71⁴.
 C₁₃H₁₂N₂ Aniline, *p*, *p'* - (iminomethylene)bis-, 403³.
 Anthranilaldehyde, phenylhydrazone, 70⁷.
 2,3 - Benzo - 6,7 - methylbenzo - 1,4,5-heptatriazine, 4,5 - dihydro-, 2132⁹.
 Guanidine, diphenyl-, 341¹, 573⁷, 672⁴, P 3205¹.
 C₁₃H₁₂N₂O₂ Carbazic acid, β - (naphthylcarbonyl)dithio-, Me ester, 3200².
 C₁₃H₁₂N₂O₂ Benzoic acid, 5 - amino - 2 - (amino-anilino)-, and - *HCl*, 232⁸.
 1 - Naphthaldehyde, 5 - methoxy-, semicarbazone, 909⁸.
 Pyruvohydroxamic acid, 1 - naphthylhydrazide, 743¹.
 C₁₃H₁₂N₂O₂ 2 - Furaldehyde, β - ethyl - β - (*p*-nitrophenyl)hydrazone, 1251⁴.
 Indazole, 2 - acetyl - 6 - (diacetyl-amino)-, 2093⁸.
 C₁₃H₁₂N₂O₄ α - Toluic acid, α - cyano - α - ethyl-2,4-dinitro-, Et ester, 1257⁴.
 C₁₃H₁₂N₂O₄ Pyrazole, allylmethyl-, picrate, 2899².
 C₁₃H₁₂ Naphthalene, ethylmethyl-, 907².

- Naphthalene hydrocarbon, m. 33.5°, from tetracyclosqualene, 1112¹.
- Naphthalene, 1 - isopropyl-(?), 2123⁴.
- C₁₅H₁₁As₂N₂O₅S See *Neoarsphenamine*.
- C₁₅H₁₁As₂N₂O₅S Methanesulfonic acid, [5 - (3-amino - 4 - hydroxyphenylarseno) - 2-hydroxyanilino]-(?), P 916⁴.
- C₁₅H₁₁As₂N₂O₅ Arsanilic acid, *N, N'* - carbonylbis[hydroxy-, P 987⁴, 2695¹.
- C₁₅H₁₁Br₂N₂ Isopyrrole, 5 - bromo - 2 - (5 - bromo - 3,4 - dimethyl - 2 - pyrrolimethylene) - 3,4-dimethyl-, and *HBr*, 86¹.
- C₁₅H₁₁Br₂N₂O Pseudocumenol, 3,6 - dibromo-*a*' - [3 (and 5) - methyl - 1 - pyrazolyl]-, 903⁴.
- C₁₅H₁₁Br₂N₂O₇ Diallylamine, dibromo - *N* - methyl-, picrate, 53⁴, 7.
- C₁₅H₁₁ClIN₂O₄ Diphenylguanidinium perchlorate, 1397⁴.
- C₁₅H₁₁Cl₂N₂O₇ Diallylamine, β, β' - dichloro-*N*-methyl-, picrate, 53⁴.
- C₁₅H₁₁INO₃ 1 - Ethyl - 3 - methyl - 6,7 - methylendioxyquinolinium iodide, 585⁴.
- C₁₅H₁₁IN₂O₃ Adipic acid, α -keto-, 3,5-diiodo-*p*-anisylhydrazone, 90⁷.
- C₁₅H₁₁NNaO Spiro[cyclohexane - 1,2' - pseudoindoxyl], Na deriv., 2882⁴.
- C₁₅H₁₁N₂O Harmaline, 1269⁷.
- C₁₅H₁₁N₂O₂ Anthranilic acid, *N* - (1 - cyano-1-cyclopentyl)-, 1635⁴.
- Benzoic acid, *m* (and *p*) - (1 - cyano - 1 - cyclopentylamino)-, 1635⁴.
- Carbazole, 1,2,3,4 - tetrahydro - 6 - methyl-5-nitro-, 91⁴.
- Cresol, [5 (or 3) - methyl - 3 (or 5) - pyrazolyl]-, acetate, 2471⁴, 2472².
- γ -Hexenaldehyde, α, β - diketo - δ - methyl-(?), α -phenylhydrazone, 2130⁴.
- , β - keto - δ - methyl - α - phenylazo - (?), 2130⁴.
- C₁₅H₁₁N₂O₃S *p* - Toluenesulfonic acid, phenylhydrazide, 68⁴.
- C₁₅H₁₁N₂O₃ Barbituric acid, 5-benzyl 5-ethyl-, 2251⁴.
- 4 - Imidazolecarboxylic acid, 2,3 - dihydro-2 - keto - 1,3 - dimethyl - 5 - phenyl-, Me ester, 3353⁴.
- 5 - Pyrazolecarboxylic acid, 3 - benzyl - 4-hydroxy-, Et ester, 3903⁴.
- 2 - Pyrrolidinedicarboxylic acid, 1 - benzalaminio - 5 - keto-, methyl ester, - *HCl*, 2897⁴.
- Spiro[cyclohexane - 1,2' - pseudoindoxyl], 5'-nitro-, 2882⁴.
- C₁₅H₁₁N₂O₃S₂ 1,4,3 - Isothiodiazine - 6 - carboxylic acid, 2 - (benzylmercapto) - 5-hydroxy-, Et ester, 383⁴.
- C₁₅H₁₁N₂O₄ Barbituric acid, 5-ethyl-5-*o*-hydroxybenzyl-, 2251⁴.
- Glycine, *N* - (α - acetamidocinnamyl)-, 1813⁴.
- Morphopyrrolidine, *N* - *p* - nitrobenzoyl-, 413¹.
- C₁₅H₁₁N₂O₃S Benzenesulfonic acid, *m*-nitro-, toluidine salt, 1103⁴.
- C₁₅H₁₁N₂O₇ Acetanilide, 4 - (dihydroxymethyl)-2-nitro-, diacetate, 1254⁴.
- C₁₅H₁₁N₂S Urea, α, α - dimethyl - β - 1 - naphthylthio-, 2688⁷.
- C₁₅H₁₁N₂O Carbanilide, 4,4' - diamino, P 2478⁴.
- Chrysoidine, 6-methoxy-, 2689⁴.
- Semicarbazide, 4 - diphenylamino-, - *HCl*,
- C₁₅H₁₁N₄O₃ Uric acid, 4,5 - dihydro - 7,9 - dimethyl-4-phenyl-, 3353⁷.
- C₁₅H₁₁N₄O₇ Pyrrole, 2,3,4 - trimethyl-, picrate, 85⁴.
- C₁₅H₁₁O 1 - Benzonaphthenone, 2,3,3a,4,5,6-hexahydro-, 84⁴.
- Cyclohexanone, 2-benzal-, 230⁴.
- Homotetraphene ketone, 2684².
- 2 - Indenealdehyde, 1,3,5 - trimethyl-(?), 910⁴.
- Xanthene, 1,2,3,4 - tetrahydro-, 408⁴.
- C₁₅H₁₁O₂ 1,3 - Cyclohexanedione, 5 - benzyl-, 228⁴.
- C₁₅H₁₁O₄ 1,2 - Cyclopropanedicarboxylic acid, 3-phenyl-, 901⁴.
- Δ^1 - 5,6 - Spirodecene - 1,2 - dicarboxylic anhydride, 3 - keto - 4 - methyl-, 3188¹.
- C₁₅H₁₁O₅ 1,2 - Cyclopropanedicarboxylic acid, 1-hydroxy - 3 - phenyl-, di-Me ester, 901⁴.
- C₁₅H₁₁O₁₀ Benzyl alcohol, 3,4,5 - trihydroxy-, tris(methyl carbonate), 2886⁴.
- C₁₅H₁₁BrO₃ Spiro[bicyclo(0.1.2)pentane - 5,1'-cyclohexane] - 1,2 - dicarboxylic acid, 2-bromo - 3 - keto - 4 - methyl-, 3188¹.
- C₁₅H₁₁ClIN₂O₇ Chlorotetramethylpyrazolium iodide, picrate, 2898⁴.
- C₁₅H₁₁ClO Cyclohexanecarboxyl chloride, 2-phenyl-(?), 1108².
- Benzoyl chloride, 2-cyclohexyl-(?), 1108².
- 1 - Indanbutyryl chloride, 2684².
- 1 - Naphthalenepropionyl chloride, 1,2,3,4-tetrahydro-, 84⁴.
- C₁₅H₁₁ClO₂ Glucoside, β -5-chlorosalicyl-, 926⁴.
- C₁₅H₁₁ClO₂ 1 - Pentanol, 1 - (trichloromethyl)-, benzoate, 1625⁴.
- C₁₅H₁₁IN₂O₃ Trimethyl(nitro - 2 - naphthyl)ammonium iodide, 3616², 3.
- C₁₅H₁₁N 1 - Naphthalenepropionitrile, 1,2,3,4-tetrahydro-, 84⁴.
- C₁₅H₁₁NO Addn. compd. of phenol and *p*-toluidine, 690².
- 1 - Benzonaphthenone, 2,3,3a,4,5,6 - hexahydro-, oxime, 84⁴.
- Δ^1 - α - Cyclopentanecetanilide, 3186⁷.
- Cyclopentanecetanilide, 3186⁷.
- Homotetraphene ketone, oxime, 2684².
- 4a - Isocarbazol - 4a - ol, 1,2,3,4 - tetrahydro-6-methyl-, 91⁴.
- Spiro[cyclohexane - 1,2' - pseudoindoxyl], 2882⁴.
- C₁₅H₁₁NO₂ 2 - Quinolineethanol, 6 - ethoxy-, and chloroplatinate, 3201⁴.
- 4(3) - Quinolone, 3,3 - diethyl - 2 - hydroxy-, 1987².
- C₁₅H₁₁NO₃ β - Butenic acid, γ - *p* - anisyl - α -(ethylimino)-, 2882⁴.
- C₁₅H₁₁NO₄ Anthranilic acid, *N* - (1 - carboxy-1-cyclopentyl)-, 1635⁴.
- Benzoic acid, *m* (and *p*) - (1 - carboxy - 1-cyclopentylamino)-, 1635⁴.
- 4-Quinolol, 6,7,8 - trimethoxy - 2 - methyl-, 912².
- C₁₅H₁₁NO₅ *m* - Diacetanilide, 2 - hydroxy-, acetate, 376⁴.
- Hydrocinnamic acid, α - acetyl - *p* - nitro-, Et ester, 3611⁴.
- C₁₅H₁₁NO₅ 2 - Benzisoufazonolol, 1 - acetyl-2-ethyl-1,2-dihydro-, acetate, 3202⁴.
- C₁₅H₁₁NO₆ Alanine, β - (*p* - carboxyoxo-phenyl)-*N*-formyl-, 2260⁴.
- Itthalic acid, 3-nitro-, Am ester, 3888⁴.
- α -ethylpropyl ester, 3888⁴; isoamyl ester, 3888⁴; methylbutyl ester, 3888⁴.

- C₁₃H₁₅N₂O 3(2) - Acenaphthenone, 1,8a - dihydro-, semicarbazone, 84⁴.
 7 - Acenaphthenone, 1,2,3,8a - tetrahydro-, semicarbazone, 84⁴.
 C₁₃H₁₅N₂O₃ Δ³ - 1,3,4 - Thiodiazoline, 4 - acetyl-2 - methylmercapto - 5 - xylilimino-, 3200¹.
 C₁₃H₁₅N₂O₂ Benzimidazole, 7 - acetamido - 1 - acetyl - 2,5 - dimethyl-, 1813³.
 C₁₃H₁₅N₂O₂ Piperonylohydroxamic acid, 6 - nitro-, piperidide, 1107².
 Trimethyl(5 - nitro - 2 - naphthyl)ammonium nitrate, 3616².
 C₁₃H₁₅ Benzonaphthene, 84⁴.
 Homotetraphene, 2684².
 Naphthalene, 1,4 - dihydro - 2 - isopropyl-, 2889².
 —, 1,2 - dihydro - 1,4,6 - trimethyl-, 910⁹.
 C₁₃H₁₅As₂N₂O₂ Benzenearsonic acid, 4,4' - ureido-bis[5 - amino - 2 - hydroxy-, 2695¹.
 C₁₃H₁₅Br₂N₂O₂ Benzenebicarbamie acid, o-(α,β - dibromoisopropyl)-, di-Me ester, 1124².
 C₁₃H₁₅ClIN Benzylchlorotrimethylpyrazolium iodide, 2898².
 C₁₃H₁₅Cl₂N Valerimidyl chloride, α,α - dichloro-N-ethyl-β-phenyl-, 2875².
 C₁₃H₁₅Cl₂NO₂ 2 - Camphanenitrile, 6 - hydroxy-, trichloroacetate, 401⁷.
 C₁₃H₁₅HgO₂ Cresotaldehyde, (acetoxymethyl)-isopropyl-, 70¹.
 Salicylaldehyde, 3 - (acetoxymethyl) - 5 - tert-butyl-, 69⁹.
 C₁₃H₁₅N Trimethyl - 2 - naphthylammonium iodide, 3616².
 C₁₃H₁₅INO 1 - Ethyl - 2 - β - hydroxyethylquinolinium iodide, 3201⁴.
 C₁₃H₁₅INO₂ 6,7 - Dimethoxy - 1,3 - dimethylquinolinium iodide, 585⁷.
 C₁₃H₁₅N₃ Cyclopentanenitrile, 1 - o (and m) - toluino-, 1635⁴.
 C₁₃H₁₅N₂O Carbazole, 1,2,3,4,4a,9a - hexahydro - 6 - methyl - 9 - nitroso-, 3199⁴.
 Cyclopentanenitrile, 1 - m - methoxyanilino-, 1635⁴.
 C₁₃H₁₅N₂O₂ Carbazole, hexahydromethylnitro-, 2898².
 C₁₃H₁₅N₂O₂S Methanesulfonic acid, anilino-, aniline salt, 3171².
 C₁₃H₁₅N₂O₂ Anthranilic acid, N - (1 - carbamyl-1-cyclopentyl)-, 1635⁴.
 Benzoic acid, N - (1 - carbamyl - 1 - cyclopentylamino)-, 1635⁴.
 Trimethyl - 2 - naphthylammonium nitrate, 3616².
 C₁₃H₁₅N₂O₂ Benzenebicarbamie acid, o-isopropenyl-, di-Me ester, 1124².
 Spiro[cyclopentane - 1,4' - nipecotic acid], 5' - cyano - 2',6' - diketone, Et ester, 228².
 C₁₃H₁₅N₂O₂ Carbanilic acid, o - formyl-, Et ester, O-carbethoxyoxime, 1119¹.
 C₁₃H₁₅N₂S Acenaphthene, 1,2,3,8a - tetrahydro-β-thiocarbamido-, 84⁴.
 C₁₃H₁₅N₄ Compd., m. 133.5-4°, from EtCHO and 2-aminopyridine, 94².
 C₁₃H₁₅N₄O₂ Toluidine, N - cyclohexyltrinitro-, 1102⁴.
 C₁₃H₁₅N₂O₂ Pyrimidine, 2,4,6 - tris(methylamino)-, picrate, 227¹.
 C₁₃H₁₅O Xanthene, 1,2,3,4,4a,9a - hexahydro-, 408².
 C₁₃H₁₅O₂ Benzoic acid, 2 - cyclohexyl-(?), 1108².
 Cinnamic acid, α,β - dimethyl-, Et ester, 1128².
 —, β-propyl-, Me ester, 229².
 Cyclohexanecarboxylic acid, 2-phenyl-(?), 1108².
 Cyclohexanone, 2 - (α - hydroxybenzyl)-, 230⁹.
 Hydrocinnamic acid, α - allyl - p - methyl-, 1646².
 —, α - (β - hydroxypropyl) - p - methyl-, lactone, 1646².
 Hydrosorbic acid, β-phenyl-, Me ester, 229².
 1-Indanbutyric acid, 2683².
 1 - Naphthalenepropionic acid, 1,2,3,4 - tetrahydro-, 84⁴.
 2 - Naphthoic acid, 1,2,3,4 - tetrahydro-4,6-dimethyl-, 1646².
 —, 1,2,3,4 - tetrahydro - 4 - methyl-, Me ester, 582¹.
 Pentenic acid, β-phenyl-, Et ester, 228².
 2 - Propanone, 1 - (5,6,7,8 - tetrahydro-2-naphthyl)-, 1983⁷.
 C₁₃H₁₅O₂ Δ³ - 2 - Butenone, 4 - (3 - methoxy - p-phenyl)-, 3612¹.
 Hydrocinnamic acid, 2 - acetyl - β,4 - dimethyl-, 910⁹.
 —, β - (α - formylisopropyl)-, 3044¹.
 Isobutyrophenone, 2 - hydroxy - 3 - methyl-, acetate, 1117⁴.
 Ketone, cyclohexyl 2,4 - dihydroxyphenyl, 3050².
 C₁₃H₁₅O₂ Caproic acid, salicylate, 1328².
 Glyoxylic acid (4,6 - dimethyl - o - anisyl)-, Et ester, 1117¹.
 —, (4,6 - dimethyl - o - phenyl)-, Me ester, 1117¹.
 Malonic acid, di - Δ³ - cyclopentenyl-, 901⁴.
 —, ethylphenyl-, di-Me ester, 906².
 —, phenyl-, di-Et ester, 2254².
 Phthalic acid, Me Bu esters, 1642⁴.
 C₁₃H₁₅O₂ Spiro[Δ² - bicyclo(0.1.2)pentene - 5,1' - cyclohexane] - 1,2 - dicarboxylic acid, 3-hydroxy - 4 - methyl-, 3187².
 C₁₃H₁₅O₂ Pentaerythritol, tetraacetate, 389².
 C₁₃H₁₇BrN₂S Benzothiazole, 5 - bromo - 1-hexylamino-, 584².
 C₁₃H₁₇BrO₂ Valeric acid, α - bromo - β - phenyl-, Et ester, 50¹.
 C₁₃H₁₇Br₂N₂S Benzothiazole, 5 - bromo - 1-hexylamino-, dibromide, 584².
 C₁₃H₁₇ClO₂ Hydrocinnamic acid, β-tert-butoxy-α-chloro-, 3051⁷.
 C₁₃H₁₇ClO₂ Glucoside, chlorosalicyl-, 926².
 C₁₃H₁₇Cl₂NO Valeramide, α,α - dichloro - N-ethyl-β-phenyl-, 2876¹.
 C₁₃H₁₇N Aniline, N - cyclohexylidene-, 915¹.
 Carbazole, 1,2,3,4,4a,9a - hexahydro-6-methyl-, 3199⁴.
 Cyclohexylamine, N-benzal-, 914².
 Hydrocinnamonitrile, α,α - diethyl-, P 2478².
 C₁₃H₁₇NO Benzamide, 2-cyclohexyl-(?), 1108².
 Cyclohexanecarboxamide, 2 - phenyl-(?), 1108².
 α-Toluic acid, piperidide, 2669².
 C₁₃H₁₇NO₂ Amylamine, N - piperonylidene-, 2882².
 Carbamic acid, tetrahydronaphthyl-, Et ester, 1678².
 Cyclohexanecarboxylic acid, 1-anilino-, 2883².
 Cyclopentanecarboxylic acid, 1 - o (and m) - toluino-, 1635⁴.

- Hydrocinuamide, β - (α - formylisopropyl)-, 3044⁴.
- 2 - Naphthalenecarboxylic acid, tetrahydro-, Et ester, 1678⁹.
- C₁₃H₁₇NO₂** Benzoic acid, *p* - butyrylamino-, Et ester, 236⁶.
- Cyclopentanecarboxylic acid, 1 - *p* - methoxyanilino-, 1635⁷.
- Hydrocinnamic acid, β - (α - formylisopropyl)-, oxime, 3044².
- Hydrocinnamohydroxamic acid, β - (α - formylisopropyl)-, 3044².
- 1(2) - Isoquinoline, 6 (and 7) - ethoxy-3,4 - dihydro - 7 (and 6) - methoxy - 2-methyl-, 1125^{4,7}.
- 3 - ⁴Pyrolocarboxylic acid, 5 - formyl - 2 (β - methyl - Δ^1 - butenyl)-, Et ester, 381⁴.
- α - Toluic acid, α - ethyl - α - (iminomethoxymethyl)-, Me ester, -HCl, 906⁴.
- C₁₃H₁₇N₂O** (See also *Pyramidone*.)
- 2 - Hexenone, 4 - phenyl-, semicarbazone, 229⁹.
- 1(2) - Naphthalenone, 3,4 - dihydrodimethyl-, semicarbazone, 910⁹, 1123⁷.
- , 3 - ethyl - 3,4 - dihydro-, semicarbazone, 1123⁹.
- C₁₃H₁₇N₂O₂** Benzaldehyde, *m* (and *p*) - nitro-, cyclohexylhydrazone, and -HCl, 1802².
- 4 - Chromanone, 3,6,8 - trimethyl-, semicarbazone, 1117⁶.
- Cyclohexanecarboxamide, 1 - *N*-nitrosoanilino-, 2882².
- C₁₃H₁₇N₂O₂** Δ^1 - 2 - Butenone, 4 - (3,4 - dimethoxyphenyl)-, semicarbazone, 3611⁹.
- Hydrocinnamic acid, α - formyl-, Et ester, semicarbazone, 906⁶.
- Isobutyrophenone, α - hydroxy-, acetate, semicarbazone, 3611⁷.
- Toluene, 3,4,5 - triacetamido-, 1813⁷.
- C₁₃H₁₇N₂O₄** Benzoic acid, *m*-amino-, addn. compd. with 1,4 - dimethyl - 2,5 - piperazinedione, 1797².
- Glycine, *N* - (*N* - β - phenylalanylglycyl)-, 378².
- Toluidine, *N* - cyclohexyldinitro-, 1102^{4,5}.
- C₁₃H₁₇N₂O₄** Carbanilic acid, *o* - (carboxyamino-carbamyl)-, di-Et ester, 2697⁶.
- C₁₃H₁₇N₂O₇** 1,2 - Propanediol, 3-amino-, picronate, 62⁹.
- C₁₃H₁₇AsN₂O₇** Carbamic acid, {[*p*-arsonophenyl-carbamyl)methyl]carbamylmethyl}-, Et ester, 71¹.
- C₁₃H₁₅Br₂N₂S** Benzothiazole, 1 - hexylamino-, dibromide, 584⁴.
- C₁₃H₁₅Cl₂NO₂** 2 - Camphanecarboxamide, 6-hydroxy-, trichloroacetate, 401².
- C₁₃H₁₅HgO₂** Phenol, 2 - (acetoxymethyl) - 4-isoumlyl-, 69².
- C₁₃H₁₅I₂NO** Trimethyl(5,6,7,8 - tetrahydro-8 - keto - 2 - naphthyl)ammonium iodide, 1123⁹.
- C₁₃H₁₅I₂NO₂** 6 (and 7) - Ethoxy - 3,4 - dihydro-7 (and 6) - methoxy - 2 - methylisoquinolinium iodide, 1125⁹.
- C₁₃H₁₅N₂** Benzaldehyde, cyclohexylhydrazone, -HCl, 1802².
- C₁₃H₁₅N₂O** Cyclohexanecarboxamide, 1-anilino-, 2882².
- Cyclopentanecarboxamide, 1 - *o* (and *m*)-toluino-, 1635^{7,8}.
- as* - Homotetrahydroisoquinoline, 8' - isopropylnitroso-, 1461³.
- Salicylaldehyde, cyclohexylhydrazone, and -HCl, 1802².
- C₁₃H₁₅N₂O₂** Benzaldehyde, cyclohexylhydrazone peroxide, 1802².
- Cyclopentanecarboxamide, 1 - *p* - methoxyanilino-, 1635⁷.
- 2 - Pentanone, 4 - methyl-, oxime, carbamate, 1628⁴.
- Piperidine, 1 - (α - nitromethylbenzyl)-, 2253⁹.
- C₁₃H₁₅N₂O₂S** Piperidine, [β - (*o* - nitrophenyl)-mercaptoethyl]-, 3191⁴.
- C₁₃H₁₅N₂O₄** Benzenecarboxylic acid, *o*-isopropyl-, di-Me ester, 1124².
- o* - Veratric acid, 6 - (hydroxymethyl)-, isopropylidenehydrazide, 3357⁹.
- C₁₃H₁₅N₂O₄** Ethanol, 2 - (ethoxyethylamino)-, *p*-nitrobenzoate, 2249¹.
- C₁₃H₁₅N₂O₅S** Benzenesulfonic acid, 3 - (1 - carbamyl-1-cyclopentylamino) - 4 - methoxy-, *Na* salt, 1635⁸.
- C₁₃H₁₅N₂S** Benzothiazole, 1 - hexylamino-, 584².
- C₁₃H₁₅N₂O** Cyclohexanone, 4 - anilinosemicarbazone, 68⁹.
- C₁₃H₁₅N₂O₂** 2 - Butanone, 4 - dimethylamino-3-methyl-, picrate, 1121⁴.
- C₁₃H₁₅N₂O₁₀** α - Glucoheptose, dinitrophenylhydrazone, 2879⁷.
- C₁₃H₁₅O** Anisole, *p*-cyclohexyl-, 3046⁶.
- p*-Cresol, 2-cyclohexyl-, 2464².
- Ether, benzyl cyclohexyl, 737⁶.
- 2 - Hexanone, 5-*p*-tolyl-, 910⁹.
- 1 - Naphthol, 1,2,3,4 - tetrahydro - 1,4,7-trimethyl-, 910⁹.
- C₁₃H₁₅O₂** Benzene, 1 - allyloxy - 2 - methoxy-4-propyl-, 72¹.
- Butyrophenone, 4 - hydroxy - 3 - propyl-, 1974⁷.
- Guaiacol, 6-allyl-4-propyl-, 72¹.
- Hydrocinnamic acid, α, β - dimethyl-, Et ester, 1123⁹.
- , α -ethyl-, Et ester, 1123⁷.
- o*-Isoeugenol, 4-propyl-, 72¹.
- 2-Pentanone, 4-benzyloxy-4-methyl-, 892⁹.
- Propiophenone, 4 - hydroxy - 5 - isopropyl-2-methyl-, 1974⁶.
- Resorcinol, 4 - (cyclohexylmethyl)-, 3050².
- C₁₃H₁₅O₂** Butyric acid, γ - benzyloxy-, Et ester, 1639².
- Spiro[furan - 3,2'(2,1') - naphthalene]-2,5(4)-dione, octahydro-, 1113⁹.
- C₁₃H₁₅O₄** 1 - Naphthoic acid, decahydro - 2,4-diketo-, Et ester, 901⁴.
- Resorcylic acid, hexyl-, 2328¹.
- C₁₃H₁₅O₂** See *Salicin*.
- C₁₃H₁₅O₂S** *d*-Glucose, toluenesulfonyl-, 2880⁴.
- C₁₃H₁₅AsN₂O₄** *m*-Arsanilic acid, *N*-acetyl-4-(1-piperidyl)-, 2694⁹.
- C₁₃H₁₅BrN₂S** Urea, α - (*p* - bromophenyl) - β -hexylthio-, 584⁴.
- C₁₃H₁₅N** Amylamine, *N* - *p* - methylbenzyl-, 2882².
- Cyclohexylamine, *N* - methyl - *N* - phenyl-, and -HCl, 1102².
- as* - Homotetrahydroisoquinoline, 8 - isopropyl-, and -HCl, 1461³.
- Piperidine, 1-phenethyl-, 2669².
- Toluidine, *N* - cyclohexyl-, and salts, 1102^{4,5}.
- C₁₃H₁₅NO** 2 - Hexanone, 5 - *p* - tolyl-, oxime, 910⁹.
- Phenol, *p* - β - 1 - piperidylethyl-, 2669².
- Valeramide, *N* - ethyl - δ - phenyl-, 2875⁹.
- C₁₃H₁₅NO₂** 2 - Camphanenitrile, 2 - hydroxy-, acetate, 1809².

- Ethanol, 2 - diethylamino-, benzoate, and chloroplatinate, 2248⁹.
- Glycine, methylphenethyl-, Et ester, 1460^{8,9}.
—, *N* - ϵ - phenylamyl-, and *HCl*, 2696⁴.
p-Isovalerophenetide, 1678⁹.
- Propiophenone, 4 - hydroxy - 5 - isopropyl-2-methyl-, oxime, 1974⁸.
- Valeraniide, *p*-ethoxy-, 236⁸.
- 3,4 - Xylic acid, 6 - (β - dimethylaminoethyl)-, chloroplatinate, 1963⁹.
- C₁₂H₁₉NO₃ Butyric acid, γ - *p* - anisyl - α - ethylamino-, 2882⁹.
Cyclopentanepropionic acid, α - cyano - 2 - keto - β , β - dimethyl-, Et ester, 1103¹.
- Ethanol, 2 - (β - dimethylaminoethoxy)-, benzoate, 3889⁸.
- , 2 - (ethoxyethylamino)-, benzoate, 2249¹.
- Pyrrolicarboxylic acid, butyryldimethyl-, Et ester, 381¹.
- , 4 - ethyl - 2 - methyl - 5 - propionyl-, Et ester, 103⁹.
- C₁₂H₁₉NO₄ Δ^1 - Cyclopentenecarboxylic acid, ethyl ester, addn. compd. with CNCH₂-CO₂Et, 2877⁷.
 Δ^2 - 1,5 - Hexenedicarboxylic acid, 5 - cyano-4-methyl-, Et Me ester, 2659¹.
3,4 - Pyrroledicarboxylic acid, 1 - isoamyl-2,5-dimethyl-, 243⁸.
- C₁₂H₁₉NO₅ Glucosamine, benzyl-, 2665⁸.
- C₁₂H₁₉NO₆ Benzylamine, α -ethyl-, acid tartrate, 3346⁹.
- C₁₂H₁₉N₂O Caprophenone, semicarbazone, 908⁸.
Semicarbazide, 2 - cyclohexyl - 4 - phenyl-, 1802³.
- C₁₂H₁₉N₂O₂ Isobutyrophenone, α -hydroxy-2,5 - dimethyl-, semicarbazone, 3611⁸.
Propiophenone, 4 - hydroxy - 3 - propyl-, semicarbazone, 1973⁷.
Salicylaldehyde, 5 - isoamyl-, semicarbazone, 69⁹.
- C₁₂H₁₉N₂O₄ Heptylamine, *N* - (2,4 - dinitrophenyl)-, 404⁹.
- C₁₂H₁₉N₂O₅ α - Glucoheptose, nitrophenylhydrazone, 2879⁷.
- C₁₂H₁₉N₂S Semicarbazide, 2 - cyclohexyl - 4-phenylthio-, 1802³.
- C₁₂H₁₉N₂O₇ Pyrrolidine, 1 - (γ - aminopropyl), picrate, 565⁸.
- C₁₂H₁₉N₂O₈ Acetamide, α - amino - *N* - isoamyl-, picrate, 1657⁸.
Isocaproamide, α - amino - *N* - methyl-, picrate, 1657⁸.
- C₁₂H₂₀ Heptane, 2-phenyl-, 3736⁸.
1,12-Tridecadiene, 2117⁴.
- C₁₂H₂₀BrP Allyldiethylphenylphosphonium bromide, 66⁸.
- C₁₂H₂₀Br₂O₂ Methyl ester, m. 53°, of dibromide of acid from decahydro - 1 - hydroxy - 1 - naphthaleneacetic acid, 1113⁷.
- C₁₂H₂₀N₂ Hydrazine, α - cyclohexyl - α - tolyl-, and salts, 1102^{2,9}.
1,3 - Propanediamine, *N* - (1,2,3,4 - tetrahydro - 2 - naphthyl)-, and di-*HCl*, 566⁸.
- C₁₂H₂₀N₂O₁ See *Novocaine*; *Procaine*.
- C₁₂H₂₀N₂O₂ Ethanol, 2 - (ethoxyethylamino)-, *p*-aminobenzoate, 2249¹.
- C₁₂H₂₀N₂S Urea, α - hexyl - β - phenylthio-, 584¹.
- C₁₂H₂₀N₂O Pinacolin, 4 - anilinosemicarbazone, 68⁹.
- C₁₂H₂₀N₂O₁ Cyclohexaneacetic acid, α -cyano-3 - keto - 1 - methyl-, Et ester, semicarbazone, 1103¹.
- C₁₂H₂₀N₂O₇ Ethyldimethylpropylammonium picrate, 2660⁹.
Isobutyltrimethylammonium picrate, 2660⁷.
- C₁₂H₂₀O Benzyl alcohol, α , α -diisopropyl-, 892⁴.
Cyclohexanone, 2 - Δ^1 - cyclohexenyl - 2-methyl-, 1103¹.
Thymol, 6-propyl-, 1974⁸.
Zierone, 474⁹.
- C₁₂H₂₀O₂ Methyl ester of acid from decahydro-1 - hydroxy - 1 - naphthaleneacetic acid, 1113⁷.
2,4 - *s* - Spirohendecanedione, 1 - ethyl-, 3187³.
- C₁₂H₂₀O₃Pb Triethyllead benzoate, 1445².
- C₁₂H₂₀O₃ 2 - Camphanecarboxylic acid, 6-keto-, Et ester, 402¹.
- C₁₂H₂₀O₄ 2 - Camphanecarboxylic acid, 6 - hydroxy-, acetate, 401⁴.
 Δ^1 - Cyclohexenemalonic acid, di-Et ester, 228².
 Δ^1 - Cyclopentenemalonic acid, α - methyl-, di-Et ester, 228¹.
2 - Naphthaleneacetic acid, 2 - carboxy-decahydro-, 1113⁸.
- C₁₂H₂₁AgO₂ ϵ - Hendecinic acid, Et ester, Ag deriv., 3601^{5,6}.
- C₁₂H₂₁N Amylamine, *N* - ethyl - ϵ - phenyl-, and *HCl*, 2883¹.
- C₁₂H₂₁NO Pentanol, dimethylamino - 5-phenyl-, 592³.
Propylamine, *N*, *N* - diethyl - γ - phenoxy-, and *HCl*, 3355⁴.
- C₁₂H₂₁NO₂ 2 - Propanone, 1 - amino - 1 - phenyl-, di-Me acetal, acetate, 75⁸.
- C₁₂H₂₁N₂O Cyclohexanone, 2 - Δ^1 - cyclohexenyl-, semicarbazone, 1103¹.
Cyclopentanone, 2 - ethyl - 2 - Δ^1 - cyclopentenyl-, semicarbazone, 1103².
- C₁₂H₂₁N₂O₂ 2 - Camphanenitile, 2 - (ethoxy-nitrosoamino)-, 2679³.
- C₁₂H₂₁N₂O₃ Cyclopentaneacetic acid, 1 - (2-ketocyclopentyl)-, semicarbazone, 1103².
5,6 - Spirodecane - 1 - carboxylic acid, 3-keto - 4 - methyl-, semicarbazone, 3188¹.
- C₁₂H₂₁NaO₂ ϵ - Hendecinic acid, Et ester, Na deriv., 3601⁵.
- C₁₂H₂₁Br₂ 1,12 - Tridecadiene, 2,12 - dibromo-, 2117⁴.
- C₁₂H₂₁Br₂O₄ Azelaic acid, α , η - dibromo-, di-Et ester, 59⁸.
- C₁₂H₂₁INO₃ (3,4 - Dimethoxyphenethyl)trimethylammonium iodide, 2669⁴.
- C₁₂H₂₁N₂ Cadaverine, *N* - phenethyl-, and di-*HCl*, 566⁷.
- C₁₂H₂₁N₂O₁ Cyclohexanecarboxylic acid, 4,5-diketo - 2,2,3 - trimethyl-, Me ester, disemicarbazone, 1259².
- C₁₂H₂₁O Cyclohexanone, 2 - (cyclohexylmethyl)-, 409¹.
Xanthene, dodecahydro-, 408⁸.
- C₁₂H₂₁O₂ 1 - Naphthaleneacetic acid, decahydro-1-hydroxy-, Me ester, 1113⁸.
- C₁₂H₂₁O₃ Glucose, diacetone - 3 - methylthio-, 1634⁴.
- C₁₂H₂₁NO₄ Glycine, *N* - (*o*-carboxycyclohexyl)-, di-Et ester, 1971⁸; and *HCl*, 245⁸.
- C₁₂H₂₁N₂O Isopulegone, 2 - ethyl-, semicarbazone, 1103⁴.
2(1) - Naphthalenone, octahydro - 4a,8 - dimethyl-, semicarbazone, 2889¹.
- C₁₂H₂₁ 2,6 - Decadiene, 2,6,9 - trimethyl-, 50⁷.
- Methane, dicyclohexyl-, 901¹, 1121¹, 3360⁹.
- C₁₂H₂₁BrN Trideconitrile, μ - bromo-, 3349⁸.

- $C_{12}H_{21}N_2OS$ Pseudothiohydantoin, 5-decyl-, 3045⁸.
- $C_{11}H_{21}N_2O_2$ 2,5 - Piperazinedione, 3 - amyl - 6-isobutyl-, 1965⁹.
- $C_{12}H_{21}O$ Cyclohexanol, 2 - (cyclohexylmethyl)-, 408⁸, 1121¹.
- $C_{12}H_{21}O_2$ Dodecenoic acid, Me ester, 895⁸, 2873⁸.
 Δ^9 - 1 - Hendecenol, acetate, 894⁸.
 Pelargonic acid, α - (β - hydroxypropyl)- η -methyl-, γ -lactone, 1097¹.
 Propionic acid, menthyl ester, 400⁸.
 Tridecenoic acid, 895⁸, 2873⁸.
 Tridecoic acid, γ - hydroxy-, lactone, 2873⁸.
- $C_{11}H_{21}O_2$ 2 - Hendecanone, 11 - hydroxy-, acetate, 894⁸.
 Lauric acid, κ -formyl-(?), 3349⁸.
 Pelargonic acid, δ - keto - γ, η - dimethyl-, Et ester, 578².
 Tridecoic acid, λ -keto-, 2873⁸.
 Undecylic acid, κ -formyl-, Me ester, 895⁸.
 —, κ -formyl - α - methyl-(?), 3349⁸.
 —, ι -keto-, Et ester, 3348⁸.
- $C_{12}H_{21}O_2$ Brassylic acid, 390⁸.
 1,10 - Decanedicarboxylic acid, methyl-, 2873⁸, 3349⁸.
- $C_{12}H_{21}O_7$ Clucoheptoside, β - cyclohexanol- α -, 2252².
- $C_{12}H_{21}O_{11}$ Cellobioside, β -methyl-, 392².
 Cellulose, β -methyl-, 2598¹.
- $C_{12}H_{21}Br$ 1 - Tridecene, 13 - bromo-, 2873⁸.
- $C_{12}H_{21}BrO_2$ Tridecoic acid, μ -bromo-, 3349⁸.
 Undecylic acid, κ -bromo-, Et ester, 3349⁸.
- $C_{12}H_{21}Br_2CoO_2 + H_2O$, 1416⁹.
 $C_{12}H_{21}Cl_2CoN_2O_2 + H_2O$, 1417¹.
 $C_{12}H_{21}Cl_2CoN_2O_{11} + H_2O$, 1417¹.
 $C_{12}H_{21}CoIO_2 + H_2O$, 1416⁹.
 $C_{12}H_{21}CoN_2O_9S_2 + H_2O$, 1417¹.
- $C_{12}H_{21}NO$ Trideconitrile, μ - hydroxy-, 3349⁸.
- $C_{12}H_{21}NO_2$ 1 - Piperidineacetic acid, 5 - ethyl-, 2 - dimethyl-, Et ester, 60⁴.
- $C_{12}H_{21}N_2O$ Cyclohexanone, 3 - isomyl - 4 - methyl-, semicarbazone, 578².
 Semicarbazone, m. 109⁹, of ketone from tetrahydroflemene, 578¹.
- $C_{12}H_{21}N_2O_2$ Ketone, 5 - hydroxy - 2,2,3,3,5-pentamethylcyclopentyl methyl, semicarbazone, 1970¹.
- $C_{12}H_{21}N_2O_2$ Capric acid, ι -formyl-, Me ester, semicarbazone, 895⁸.
- $C_{12}H_{21}BrClN_2O.PtS$, 3167⁸.
- $C_{12}H_{21}BrN$ Spiro[copellidine - 1,1' - piperidine], 1-bromo-, 96².
- $C_{12}H_{21}BrNO$ Tridecamide, μ - bromo-, 3349⁸.
- $C_{12}H_{21}Br_2$ Dodecane, 1,12 - dibromo-3-methyl-, 3349⁸.
 Tridecane, 1,12-dibromo-, 2873⁸.
- $C_{12}H_{21}N_2O_4$ Glutaric acid, α, γ - bis(diethyl amino)-, 60⁸.
- $C_{12}H_{26}O$ Decanol, cyclopropyl-, 2666².
 2 - Tridecanone, 2659¹.
 1 - Tridecenol, 2873⁸.
- $C_{12}H_{21}O_2$ Pelargonic acid, Bu ester, P 593⁸.
 Propionic acid, decyl ester, 2658⁸.
 Tridecoic acid, 13⁷.
- $C_{12}H_{21}O_2$ Tridecanoic acid, γ -hydroxy-, 2873⁸.
- $C_{12}H_{21}ClN_2O.PtS + 5H_2O$, 3167⁸.
- $C_{12}H_{21}NO_2$ Tridecamide, μ -hydroxy-, 3349⁸.
- $C_{12}H_{21}N_2$ Copellidine, 1 - (ϵ - aminoamyl)-, 96².
- $C_{12}H_{21}N_2O$ Isocaproamide, N - ethyl - α - isoamylamino-, and -HCl, 1657⁸.
 Propionamide, N - isoamyl - α - isoamylamino-, and -HCl, 1657⁸.
- $C_{12}H_{21}O$ Ether, decyl propyl, 2658⁷.
- $C_{12}H_{21}O_2$ 1,12 - Dodecanediol, 3 - methyl-, 3349⁸.
 Enanthaldehyde, di-Pr acetal, 3608⁸.
 1,12-Tridecanediol, 2873⁸.
- $C_{12}H_{21}O_2Pb$ Triethyllead enanthate, 1445⁸.
- $C_{12}H_{21}O_2S_2$ Arabinose, di-Bu mercaptal, 64⁸.
- $C_{12}H_{21}O_7$ Galactose, pentamethyl-, di-Me acetal, 3891⁷.
 Mannose, pentamethyl-, di-Me acetal, 3891⁷.
- $C_{12}H_{21}O_2P_2$ Hexosephosphoric acid, di-, hepta-Me ester, 2462⁹.
- $C_{12}H_{21}IN_3$ Hexaethylguanidinium iodide, 2878⁸.
- $C_{12}H_7Br_4O_2$ Phenanthrenequinone, tetra-bromo-, 2895⁴.
- $C_{12}H_7BrClO_2$ Anthraquinone, 1 - bromo - 5 (and 8)-chloro-, 1812^{1,2}.
- $C_{12}H_7Br_2ClO$ 9(10) - Phenanthrone, 2,7-dibromo - 10,10 - dichloro-, 2895⁴.
- $C_{12}H_7Br_2O_2$ Anthraquinone, dibromo-, 1812^{1,2}.
 Phenanthrenequinone, 2,7-dibromo-, 2895⁴.
- $C_{12}H_7ClNO$ Anthraquinone, 6(and 7) - chloro-1-nitro-, 1812².
 4 - Fluorene-carboxyl chloride, 9 - keto-7-nitro-, 1987⁸.
- $C_{12}H_7Cl_2O_2$ Anthraquinone, dichloro-, 241⁸, 1811², 1812^{1,2,3,7}, 3362⁴.
- $C_{12}H_7Cl_2O_2S$ 2 - Anthraquinonesulfonyl chloride, 6(and 7) - chloro-, 1812^{1,2}.
- $C_{12}H_7Cl_2O_2S_2$ Anthraquinonedisulfonyl chloride, 1811^{1,2,3}, 1812².
- $C_{12}H_7Cl_4O_2$ Peroxide, bis(2,4 - dichlorobenzoyl), 3181².
- $C_{12}H_7N_2O_6$ Anthraquinone, dinitro-, 1115⁹, P 1464³.
 Compd., m. 255-8°, from indigo yellow 3
 G ciba and HNO₃, 90¹.
- $C_{12}H_7N_2O_7$ Diphenic anhydride, 5,5' - dinitro-, 3190⁹.
- $C_{12}H_7N_2O_{10}$ Benzil, 3,5,3',5' - tetranitro-, 1983⁸.
- $C_{12}H_7Br_2O_2$ Quinizarin, 2-bromo-, 3192¹.
- $C_{12}H_7Br_2ClO$ 9 - Phenanthrenol, 2,7 - dibromo-10-chloro-, 2895⁴.
- $C_{12}H_7ClO_2$ Anthraquinone, 2-chloro-, P 745⁹.
- $C_{12}H_7ClO_2$ Anthraquinone, chlorohydroxy-, 1813^{2,3}, P 2906⁷.
- $C_{12}H_7ClO_2$ Quinizarin, 2-chloro-, P 3370⁹.
- $C_{12}H_7Cl_2O_2S$ 1 - Anthraquinonesulfonyl chloride, 1812².
- $C_{12}H_7ClO_2S$ Anthraquinonesulfonic acid, chloro-, and Ba salts, 1812^{1,2,3}.
- $C_{12}H_7Cl_2NO$ Diphenyl chloride, 3(and 5)-nitro-, 3190⁹.
- $C_{12}H_7Cl_2N_2O_4$ 2,1,3 - Benzotriazol - 5 - ol, 4,6,7 - trichloro - 2 - (p - nitrophenyl)-, acetate, 2689⁸.
- $C_{12}H_7NO_4$ Diphenic anhydride, 5-nitro-, 1987⁸, 3190⁹.
 4 - Fluorene-carboxylic acid, 9 - ketonitro-, 1987⁸.
- $C_{12}H_7N_2O_2$ 2,1,3 - Benzotriazole - 4 - glyoxylic acid, 5 - hydroxy - 2 - phenyl-, lactone, 2689⁸.
- $C_{12}H_7Br_2O_2$ 9,10 - Phenanthrenediol, 2,7 - dibromo-, 2895⁴.
- $C_{12}H_7ClNO_2$ Anthraquinone, 1 - amino - 6 (and 7)-chloro-, 1812².
- $C_{12}H_7ClN_2O_2$ Indazole, 4 - chloro - 2 - (nitrobenzoyl)-, 1119⁸.
 Isoindazole, 4 - chloro - 1 - (nitrobenzoyl)-, 1119⁸.
- $C_{12}H_7ClO_2P$ Phosphodisal, C - monochloride C,P - anhydride, 3056⁷.
- $C_{12}H_7Cl_2N_2O_2$ 4,5 - Benzimidazole-dione, 6,7-dichloro - 2 - methyl - 1 - phenyl-, 2692¹.

- C₁₄H₈Cl₂O₈ Benzoic acid, *o*-(dichlorobenzoyl)-, 241⁸, 910⁷, 3362⁴.
- C₁₄H₈Cl₂O₈ Peroxide, bis(*p* - chlorobenzoyl)-, 3181⁴.
- C₁₄H₈Cl₂NOS Benzothiazole, 3,4,6 - trichloro-5-methoxy-1-phenyl-, 2692⁴.
- C₁₄H₈CuNa₂O₈ Sodium cuprisalicylate, 3168⁹.
- C₁₄H₈F₂O₈ Benzoic anhydride, *m,m'* - bis-(fluorosulfonyl)-, 3604⁴.
- C₁₄H₈I₂S₂ Δ^{1,3'} - Bi[1,3 - benzodisulfone], tetraiodide, 73⁴.
- C₁₄H₈N₂O₄ 4 - Fluorencarboxamide, 9 - keto-7-nitro-, 1987⁴.
- C₁₄H₈N₂O₈ Benzil, *m,m'*-dinitro-, 1983⁴.
- C₁₄H₈N₂O₈ Diphenic acid, dinitro-, 2892¹.
- C₁₄H₈N₂O₁₀S₂ α,α' - Bi - *o* - toluenesulfonic acid, α,α' - dihydroxy - 5,5' - dinitro-, dianhydride, 908⁴.
- 2,2' - Stilbenedisulfonic acid, α - hydroxy-4,4' - dinitro-, anhydride, 908⁴.
- 2,2' - Tolandisulfonic acid, 4,4' - dinitro-, and *di-K salt*, 908⁴.
- C₁₄H₈N₂O₈ Δ^{1,3'}(^{1,3'}) - Bi[1,4 - imidazopyridine]-2,2'-dione(?), 1263⁹.
- C₁₄H₈N₂O₈ Indazole, 6(and 7) - nitro - 2 - nitrobenzoyl-, 1120^{1,4}.
- Isindazole, 6(and 7) - nitro - 1 - nitrobenzoyl-, 1120^{1,4}.
- C₁₄H₈O₈ Spiro[1,4 - benzodithiin - 2,2'(3)-1,3 - benzodithiol]-3-one, 73⁴.
- C₁₄H₈O₈ See Anthraquinone; Phenanthrene-quinone.
- C₁₄H₈O₈ Anthracenediol, sulfite, 1984^{1,2}.
- C₁₄H₈O₈ (See also *Alisarin*.)
- Quinizarin, P 249⁴.
- C₁₄H₈O₈S₂ 2,2' - Bis - 1,3 - benzodithiylum sulfate, 73¹.
- C₁₄H₈O₈ (See also *Purpurin*.)
- Anthraquinone, 1,2,5 - trihydroxy-, 909⁴.
- C₁₄H₈O₈S Anthraquinonesulfonic acid, 876¹, P 1464⁴; and salts, 1811^{4,5}, 1812^{4,5}.
- C₁₄H₈O₈ Rufiopin, 910².
- C₁₄H₈O₈ 1,4,5,8 - Naphthalenetetracarboxylic acid, P 593⁴.
- C₁₄H₈O₈S₂ Anthraquinonedisulfonic acid, and salts, 1811⁷, 1812⁸.
- C₁₄H₈S₂ Δ^{1,3'} - Bi[1,3 - benzodithiole], 4^{3,2}.
- C₁₄H₈AgN₂O₈S₂ Benzisulfonazole, 2 - [(*o*-carboxyphenyl) - sulfonylimino] - 1,2-dihydro-, silver deriv., *Ag salt*, 2888².
- C₁₄H₈AN₂O₈ Dibenzoarsenic acid, 2,8-dimethoxy - 1,3,7,9 - tetranitro-, 905⁴.
- C₁₄H₈Br₂N₂O₁₀S₂ α,α' - Bi - *o* - toluenesulfonic acid, α - bromo - α' - hydroxy - 5,5'-dinitro-, α',1' - anhydride, *Na salt*, 908⁴.
- 2,2' - Stilbenedisulfonic acid, α - bromo-4,4' - dinitro-, *di-K salt*, 908⁴.
- C₁₄H₈BrO₄ Glutaric anhydride, α - bromo - γ-cinnamal-β-keto-, 1798⁹.
- C₁₄H₈Br₂N₂O₈ Acetanilide, 2,6 - dibromo - 4-(dinitrophenyl)-(?), 1109⁹.
- C₁₄H₈ClN₂S₂ Benzothiazole, ? - benzalamino-4-chloro-1-mercaptop-, 2699².
- C₁₄H₈ClN₂O₄ Benzimidazole, 1 - (4 - chloro-3 - nitrophenyl) - 2 methyl - 5 - nitro-, 2691¹.
- C₁₄H₈ClO₈ Benzaldehyde, 2-chloro-4-hydroxy-, benzoate, 3189⁴.
- Glutaconic anhydride, β - chloro - γ - cinnamal-, 3615⁷.
- Salicylaldehyde, 4-chloro-, benzoate, 3189⁷.
- C₁₄H₈Cl₂O 1 - β - Butenonaphthone, γ - trichloro-, 3614⁴.
- C₁₄H₈NO₈ Anthraquinone, amino-, P 329⁴, 903⁴, P 3908⁹.
- C₁₄H₈NO₈S 4 - Benzisothiazolol, benzoate, 2692⁴.
- C₁₄H₈NO₈ Diphenic acid, 3-nitro-, 3190⁴.
- C₁₄H₈N₂NaO₈ 1,4 - Imidazopyridin - 2(3) - one, 3 - *p* - hydroxybenzal-, *Na deriv.*, 1265².
- C₁₄H₈N₂NaO₈S₂ Benzisulfonazole, 2 - [(*o*-carboxyphenyl)sulfonylimino] - 1,2-dihydro-, sodium deriv., *Na salt*, 2888².
- C₁₄H₈N₂O₈ Dinicotinonitrile, 4 - benzyl - 2,5-dihydro - 6 - hydroxy - 2 - keto-, 228⁷.
- C₁₄H₈N₂O₈ 1,4 - Imidazopyridin - 2(3) - one, 3-nitrobenzal-, and salts, 1265².
- Indazole, 2 - benzoyl - 7 - nitro-, 1120⁴.
- Isindazole, 1 - benzoyl - 7 - nitro-, 1120⁴.
- C₁₄H₈N₂O₈ Guaiaacol, 3,4,6 - trinitro-, benzoate, 377¹.
- C₁₄H₈ (See also *Anthracene*; *Phenanthrene*.)
- Tolan, 2267².
- C₁₄H₈BrN 7,8 - Benzoquinoline, 6 - bromo - 2-methyl-, and chloroplatinate, 96⁹.
- C₁₄H₈BrN₂O 1,2,4 - Triazol - 5 - ol, 3 - (*p*-bromophenyl)-1-phenyl-, 743⁴.
- C₁₄H₈Br₂ Ethylene, 1,1 - dibromo - 2,2 - diphenyl-, 234².
- C₁₄H₈Br₂N₂O 5 - Benzimidazolol, 4,6 - dibromo-2-methyl-1-phenyl-, 2691¹.
- 1,4 - Imidazopyridin - 2(3) - one, 3 - benzal-, dibromide, 1265¹.
- C₁₄H₈Br₂N₂O₈ Acetanilide, 2 - bromo - 4 - (*p*-bromophenyl)-6-nitro-, 2680⁴.
- , 2,6(?) - dibromo - 4 - (*p* - nitrophenyl)-, 1109⁹.
- C₁₄H₈Br₂N₂O₄ Bibenzyl, 4,4' - dibromo - 2,2'-dinitro-, 399⁴.
- Ethane, *s* - bis(4 - bromo - 3 - nitrophenyl)-, 2681¹.
- C₁₄H₈Br₂N₂O₁₀S₂ α,α' - Bi - *o* - toluenesulfonic acid, α,α' - dibromo - 5,5' - dinitro-, *di-K salt*, 908⁴.
- C₁₄H₈BrN₂S₂ Benzothiazole, 1 - amino - 3-bromo-, tribromide, 2688⁴.
- C₁₄H₈ClN Benzoquinoline, chloromethyl-, 96^{7,8}, 97¹.
- C₁₄H₈ClNOS Benzothiazole, 6 - chloro - 5-methoxy-1-phenyl-, 2692².
- C₁₄H₈ClN₂O₄ 4(7) - Benzimidazolone, 6 - chloro-5 - hydroxy - 2 - methyl - 7 - phenylimino-, 2691¹.
- Benzimidazole, 1 - (chlorophenyl) - 2 - methyl-5-nitro-, 2691².
- α - Tolunitrile, α - *p* - chloroanilino - *m*-nitro-, 2125².
- C₁₄H₈ClN₂O₈ 5 - Benzimidazolol, 4 - chloro-2 - methyl - 6 - nitro - 1 - phenyl-, 2691¹.
- C₁₄H₈ClN₂O₈ Acetanilide, 2 - chloro - 6 - nitro, 4 - (*p* - nitrophenyl)-, 2680⁷.
- C₁₄H₈Cl₂N₂O 5 - Benzimidazolol, 4 - chloro - 1-chlorophenyl)-2-methyl-, 2691¹.
- , 4,6 - dichloro - 2 - methyl - 1 - phenyl-, 2691¹.
- C₁₄H₈Cl₂N₂O₈ 4,5-Benzimidazole, 6,7-di-chloro-2-methyl-1-phenyl-, 2692².
- C₁₄H₈Cl₂N₂O₈ Bibenzyl, 4,4'-dichloro-2,2'-dinitro-, 399⁴.
- C₁₄H₈Cl₂N₂O₁₀S₂ α,α' - Bi-*o*-toluenesulfonic acid, α,α' - dichloro-5,5'-dinitro-, *di-K salt*, 908⁴.
- C₁₄H₈Cl₂O₈Zr Compd. from ZrCl₄ and salicylaldehyde, 1069⁹.
- C₁₄H₈Cl₂O₈Ti Compd. from salicylic acid and TiCl₄, 739⁴.

- $C_{14}H_{10}Cl_2PtS_2$ 1,3-Benzodithiylum chloroplatinate, 731.
- $C_{14}H_{10}CoN_2O_4$ Addn. compd. of CoC_2O_4 and pyridine, 1285^a.
- $C_{14}H_{10}N_2O$ 1,4-Imidazopyridin-2(3)-one, 3-benzal-, and *HCl*, 12651.
- 3-Pseudoindolone, 2-anilino-, 912^a.
- Pseudoindoxyl, 2-phenylimino-, 912^a.
- $C_{14}H_{10}N_2O_2$ 7,8-Benzoquinoline, 2-methyl-6-nitro-, and chloroplatinate, 96^a.
- 1,4-Imidazopyridin-2(3)-one, 3-*p*-hydroxybenzal-, and H_2SO_4 , 1265^a.
- , 3-salicylal-, and *HCl*, 1265^a.
- 3-Pseudoindolone, 2-(*N*-hydroxyanilino)-(?), 2127^a.
- Pseudoindoxyl, 2-phenylimino-(?), *N*-oxide, 2127^a.
- $C_{14}H_{10}N_2O_2S$ Benzothiazole, methyl-1-(nitrophenyl)-, 1985^a.
- $C_{14}H_{10}N_2O_2$ Compd., m. 150–1°, from 1-ethinyl-2-nitrobenzene and $PhNO$, 2127^a.
- $C_{14}H_{10}N_2O_4$ Stilbene, *p*,*p'*-dinitro-, 2255^a.
- $C_{14}H_{10}N_2O_5$ Benzoic acid, *o*-(4-amino-3-nitrobenzoyl)-, P 746^a.
- Diphenamic acid, 4 (and 4')-nitro-, 1987^a.
- $C_{14}H_{10}N_2O_6$ Benzyl alcohol, 2,4-dinitro-, benzoate, 2457^a.
- $C_{14}H_{10}N_2O_8S_2$ Benzenesulfonazole, 2-[(*o*-carboxyphenyl)sulfonylimino] - 1,2 - dihydro-, 2888^a.
- $C_{14}H_{10}N_2O_7$ Guaiacol, 3,4-dinitro-, benzoate, 376^a.
- Salicylic acid, 2,4-dinitrobenzyl ester, 2457^a.
- $C_{14}H_{10}N_2O_{10}S_2$ *m*-Toluenesulfonic acid, 6-hydroxy-5-nitro-, bimol. cyclic sulfonylide, 3897^a.
- $C_{14}H_{10}N_2O_{11}S_2$ α , α' -Bi-*o*-toluenesulfonic acid, α -keto-5,5'-dinitro-, and tri-*K* salt, 908^a, 909^a.
- $C_{14}H_{10}N_2S$ Benzisothiazole, 4-benzalamino-, 2692^a.
- 2(3)-Quinazolone, 3-phenyl-2-thio-, 5877^a.
- $C_{14}H_{10}N_2S_2$ Benzothiazole, 5-benzalamino-1-mercapto-, 26891^a.
- $C_{14}H_{10}N_4$ Azobenzene, oxaly-4,4'-diamino-, 402^a.
- Compd. from pseudoisatin and *o*-amino-phenylhydrazine, 2132^a.
- $C_{14}H_{10}N_4O$ 1,2,3-Benzotriaz-4(3)-one, 3-benzalamino-, 2697^a.
- $C_{14}H_{10}N_4O_2$ 3,3'-Bi[1,4-imidazopyridine]-2,2'-diol(?), 1263^a.
- 1,3,4-Oxadiazole, 2,3-dihydro-2-nitrosoimino-3,6-diphenyl-, 913^a.
- $C_{14}H_{10}N_4O_2$ 1,4 - Imidazopyridine - $\Delta^{(2)}$ - α -acetic acid, α -(1,2-dihydro-2-imino-1-pyridyl)-2-keto-, and *Na* salt, 1264^a.
- 2-Indazolecarboxanilide, 6-nitro-, 1120^a.
- 1-Isindazolecarboxanilide, 6-nitro-, 1120^a.
- Pseudoisatin, 6-nitro-, phenylhydrazone, 912^a.
- $C_{14}H_{10}N_4O_3$ Ether, bis(2,6-dinitro-*p*-tolyl), 1253^a.
- $C_{14}H_{10}N_4O_6$ *o*,*o'*-Bianisole, 4,6,4',6'-tetranitro-, 19821, 26811.
- $C_{14}H_{10}N_4O_5$ 5-Isindazolol, 4-(5-isindazolylazo)-, 2693^a.
- $C_{14}H_{10}O_2$ (See also *Benzil*.)
- Acenaphthenequinone, dimethyl-, 16457^a.
- 2,3-Anthracenediol, 19841.
- Phthalide, 2-phenyl-, 911^a.
- $C_{14}H_{10}O_4$ 4-Dibenzofuranol, acetate, 2180^a.
- Phthalide, 2-(*p*-hydroxyphenyl)-, 3356^a.
- 9-Xanthencarboxylic acid, 3055^a.
- $C_{14}H_{10}O_4$ (See also *Benzoyl peroxide*.)
- Acenaphthoquinone dimethoxy-, 1645^a, 16461.
- Diphenic acid, 30557, 3901^a.
- Protocatechualdehyde, benzoate, 1107^a.
- $C_{14}H_{10}O_5$ (See also *Genisin*.)
- Benzaldehyde, 2,4,6-trihydroxy-, benzoate, 31951.
- Benzoic acid, *p*,*p'*-oxybis-, and di-*Ag* salt, 1253^a.
- Benzoic anhydride, 2430^a.
- $C_{14}H_{10}O_6$ 1,4-Naphthoquinone, 5,6-dihydroxy-, diacetate, 30531.
- α , γ -Pentadienic acid, β , δ , δ -trihydroxy-, δ -lactone, acetate, benzoate, 1798^a.
- $C_{14}H_{10}O_7$ Compds. from di-Et xanthophanate, 1269^a.
- $C_{14}H_{10}O_8$ Digallic acid, 824^a, 3747^a.
- $C_{14}H_{11}AgN_2O_8$ Benzenesulfonazole, 1,2-dihydro-2-tolylsulfonylimino-, silver deriv., 2888^a.
- $C_{14}H_{11}AgN_2O_5$ Biurea, β , β' -bis(phenylazo)-, silver deriv., 2903^a.
- $C_{14}H_{11}AsO_4$ Compd., m. 146°, from arsonoacetic acid and pyrocatechol, 905^a.
- $C_{14}H_{11}Br$ Ethylene, 2-bromo-1,1-diphenyl-, 909^a.
- Stilbene, *p*-bromo-, 2893^a.
- $C_{14}H_{11}BrClNO$ Acetanilide, 4-(*p*-bromophenyl)-2-chloro-, 26807.
- $C_{14}H_{11}BrINO$ 3-Pyranoquinolone, 2-bromo-8-methyl-, methiodide, 382^a.
- $C_{14}H_{11}BrN_2O$ 5-Benzimidazolol, 4-bromo-2-methyl-1-phenyl-, 26911.
- $C_{14}H_{11}BrN_2O_2$ 1-Phthalimidomethylpyridinium bromide, 16271.
- $C_{14}H_{11}BrN_2O_3S$ 1-Methyl-4-nitro-3-phenylbenz-isothiazolium bromide, 2693^a.
- 4-Nitro-1-*p*-tolylbenz-isothiazolium bromide, 2692^a.
- $C_{14}H_{11}BrN_2O_4$ Acetanilide, 2(?) - bromo-6-nitro-4-phenyl-, 2680^a.
- , 4-(*p*-bromophenyl)-2-nitro-, 370^a, 2680^a.
- $C_{14}H_{11}BrO_2$ Phenol, 2 (and 3)-bromo-4-methoxy-, benzoate, 1253^a.
- $C_{14}H_{11}Br_2NO$ Acetanilide, 2,6-dibromo-4-phenyl-, 1109^a.
- $C_{14}H_{11}Br_2NO_2$ Creosol, 5,6-dibromo- α -phenylimino-, 2258^a.
- $C_{14}H_{11}Br_2$ Bibenzyl, *p*, α , α' -tribromo-, 2893^a.
- $C_{14}H_{11}Br_2O_2Ti$ Compd. from salicylaldehyde and $TiBr_4$, 739^a.
- $C_{14}H_{11}ClIN_2O$ 5-Benzimidazolol, 4-chloro-2-methyl-1-phenyl-, 26911.
- , 1-(chlorophenyl)-2-methyl-, 2691^a.
- , 4-chloro-1-*p*-tolyl-, 2691^a.
- $C_{14}H_{11}ClIN_2O_2$ Hydrazine, α -benzoyl- β -(*p*-chlorobenzoyl)-, 573^a.
- $C_{14}H_{11}ClIN_2O_3S$ 4-Nitro-1-*p*-tolylbenz-isothiazolium chloride, 2692^a.
- $C_{14}H_{11}ClIN_2O_4$ Acetanilide, 2-chloro-4-(*p*-nitrophenyl)-, 2680^a.
- , 4-(*p*-chlorophenyl)-2-nitro-, 2680^a.
- $C_{14}H_{11}ClIN_4O_2$ 1,2,3-Benzotriazol-5(4)-one, 6-chloro - 4,7 - dimethyl - 4 - nitro - 1 - phenyl-, 2690^a.
- $C_{14}H_{11}ClO_5$ 2-*p*-Anisyl-1,3-benzodithiylum chloride, 19851.
- $C_{14}H_{11}ClO_6$ Acetic acid, chloro-, *o*-phenylphenyl ester, 1117^a.
- $C_{14}H_{11}ClO_8$ Naphthalic acid, 4-chloro-, di-Me ester, 2083^a.
- $C_{14}H_{11}ClNO$ Acetanilide, chloro-4-(*p*-chlorophenyl)-, 11101.
- $C_{14}H_{11}Cl_2N_2O_2$ Benzaldehyde, *p*-nitro-, 2,3-dichloro-*p*-anisylhydrazone, 2690^a.

- C₁₄H₁₁Cl₃O₂ 1-Butyronaphthone, γ -trichloro- β -hydroxy-, 3614².
- C₁₄H₁₁Cl₃O₂Ti Compd. from salicylaldehyde and TiCl₄, 739⁷.
- C₁₄H₁₁Cl₃N₃O 1,2,3-Benzotriazol-5(4)-one, 4,6,6,7-tetrachloro-4,5,6,7-tetrahydro-4,7-dimethyl-1-phenyl-, 2690².
- C₁₄H₁₁KN₂O₄S₂ Benzisulfonazolate, 1,2-dihydro-2-tolylsulfonylimino-, potassium deriv., 2888².
- C₁₄H₁₁N Acetonitrile, diphenyl-, 52⁷.
Acridine, methyl-, 1815²; salts, 1810¹.
- C₁₄H₁₁NOS Benzisothiazole, 4-methoxy-2-phenyl-, 2693².
Benzothiazole, 1-(*p*-hydroxyphenyl)-4 (and 6)-methyl-, 1985².
—, 5-methoxy-1-phenyl-, 2692².
- C₁₄H₁₁NO₂ Benzil, oxime, 565².
Ethylene, 2-nitro-1,1-diphenyl-, 52².
3-Pyranquinolone, 8,10-dimethyl-, and salts, 411².
- C₁₄H₁₁NO₂ Picolinic acid, 3-benzoyl-, Me ester, 1651².
—, 3-(α -hydroxy- α -methoxybenzyl)-, lactone, 1651².
- C₁₄H₁₁NO₂S Benzophenone, 2-(methylmercapto)-5-nitro-, 2693¹.
- C₁₄H₁₁NO₂ Salicylohydroxamic acid, Bz deriv., and K salt, 3898².
- C₁₄H₁₁NO₂S₂ 2-*p*-Anisyl-1,3-benzodithiylum nitrate, 1985¹.
- C₁₄H₁₁NO₂ Guaiacol, 3-nitro-, benzoate, 376⁷.
- C₁₄H₁₁N₂NaO₄S₂ Benzisulfonazolate, 1,2-dihydro-2-tolylsulfonylimino-, sodium deriv., 2888².
- C₁₄H₁₁N₂ Indazole, 6-benzalmino-, 1120⁴.
- C₁₄H₁₁N₂O 1,2,3-Benzotriazole, 1-acetyl-5 (and 6)-phenyl-, 237².
Indazole, 6-salicylalmino-, 1120⁴.
1,3,4-Oxadiazole, 2,3-dihydro-2-imino 3,5-diphenyl-, and -HCl, 913⁴.
Phenazine, 2-acetamido-, 1815².
3-Pseudoindolone, 6-amino-2-anilino-, 912⁴.
Pseudoisatin, phenylhydrazone, 912⁴.
1,2,4-Triazol-5-ol, 1,3-diphenyl-, 443².
- C₁₄H₁₁N₂O₂ Pseudoisatin, 1-hydroxy-, phenylhydrazone, 2127².
 α -Tolunitrile, α -anilino-*m*-nitro-, 2125⁷.
- C₁₄H₁₁N₂O₂ Benzaldehyde, 2,3-methylenedioxy-, *p*-nitrophenylhydrazone, 588⁴.
Hydrazine, α -benzoyl- β -(*p*-nitrobenzoyl)-, 573².
- C₁₄H₁₁N₂O₂ Acetanilide, 2-nitro-4-(*p*-nitrophenyl)-, 2689².
Acetanilide, 2(or 4)-nitro-6(or 2)-(*p*-nitrophenyl)-, 1260¹.
Benzaldehyde, *o*(*m* and *p*)-nitro-, *N*- and *O*-*p*-nitrobenzoyloxime, 2257^{1,2,4,6}.
- C₁₄H₁₁N₂O₂ Benzaldehyde, methoxydinitro-, 2675^{2,4}.
- C₁₄H₁₁N₂ Isatin-*o*-phenylenedihydrazone, 2132².
- C₁₄H₁₁N₂O₂S Benzothiodiazole, 4-acetamido-3-phenylazo-, 2690².
- C₁₄H₁₁N₂O₂ 2,1,3-Benzotriazole, 5-acetamido-4-nitro-2-phenyl-, 2689⁴.
- C₁₄H₁₁N₂O₂ Naphthyridine, dihydro-, picrate, 3203².
- C₁₄H₁₁ (See also *Stilbene*.)
Ethylene, *as*-diphenyl-, 909², 1060².
Phenanthrene, 9,10-dihydro-, 2685².
- C₁₄H₁₁AsClO₂ Dibenzarsenole, 5-chloro-2,8-dimethoxy-, 605².
- C₁₄H₁₁BrNO Acetanilide, 2-bromo-4-phenyl-, 1109², 1259².
Benzamide, *N*-(*p*-bromobenzyl)-, 53².
- C₁₄H₁₁BrN₂O Creosol, 6-bromo- α -phenylimino-, 2258².
- C₁₄H₁₁BrN₂O₂ Glyoxylohydroxamic acid, (*p*-bromophenyl)-, phenylhydrazone, 743².
- C₁₄H₁₁Br₂ Bibenzyl, *o,o'*-dibromo-, 2686¹.
- C₁₄H₁₁BrN₂O Acetanilide, *ar*-bromo- α -(bromoanilino)-, 1801².
Toluene, azoxybis(α -bromo-, 573¹.
- C₁₄H₁₁BrN₂O₂ Vanillin, bromo-, *p*-bromophenylhydrazone, 1803^{2,3}, 2258⁴.
—, 5,6-dibromo-, phenylhydrazone, 2258⁴.
- C₁₄H₁₁ClNO Acetanilide, chlorophenyl-, 1259^{2,3}.
Benzamide, *N*-(*m*-chlorobenzyl)-, 54¹.
- C₁₄H₁₁ClNO₂ Benzmimidyl chloride, *N*-*p*-anisyl-, 3190².
Creosol, 6-chloro- α -phenylimino-, 906².
- C₁₄H₁₁ClNO₂S₂ Benzenesulfonic acid, *p*-chlorothiyl-, *p*-acetamidophenyl ester, 234².
- C₁₄H₁₁ClN₂ Benzmimidazole, 5-amino-4 (and 6)-chloro-2-methyl-1-phenyl-, 2001¹.
—, 5-amino-1-(chlorophenyl)-2-methyl-, 2691².
—, 5-amino-4-chloro-1-*p*-tolyl-, 2691².
- C₁₄H₁₁ClN₂O 1,2,3-Benzotriazol-5-ol, 6-chloro-4,7-dimethyl-1-phenyl-, 2690².
C₁₄H₁₁ClN₂O 1,2,3-Benzotriazol-5(4)-one, 6-chloro-4-hydroxy-4,7-dimethyl-1-phenyl-, 2690².
- C₁₄H₁₁ClN₂O₂ Acetanilide, 2-*p*-chloroanilino-5-nitro-, 2691².
Anisaldehyde, 2-chloro-, *p*-nitrophenylhydrazone, 3189².
Benzaldehyde, 4-chloro-2-methoxy-, *p*-nitrophenylhydrazone, 3189².
- C₁₄H₁₁Cl₂O₂ *m,m'*-Bianisole, 6,6'-dichloro-, 905².
- C₁₄H₁₁Cl₂O₂Zr Addn. compd. of ZrCl₄ and salicylaldehyde, 1069².
- C₁₄H₁₁INO₂ 3-Keto-7,8-dimethylpyranquinolinium iodide, 411².
- C₁₄H₁₁N₂O Benzmimidazole, 2-phenoxy-methyl-, P 158¹.
5-Benzimidazolol, 2-methyl-1-phenyl-, 2691¹.
—, 1-*p*-tolyl-, 2691⁴.
Carbazole, 2,4-dimethyl-9-nitroso-, 230².
1,4-Imidazopyridine 2(3)-one, 3-benzyl-, -HCl, 1265¹.
2-Naphthol, 1-[3(or 5)-methyl-5(or 3)-pyrazolyl]-, 2472².
 α -Tolunitrile, α -(*p*-hydroxyanilino)-, 1449².
- C₁₄H₁₁N₂O₂ 2(1)-Quinazolone, 3,4-dihydro-4-hydroxy-3-phenyl-2-thio-, 587².
- C₁₄H₁₁N₂O₂ 2(1)-Quinazolone, 3,4-dihydro-4-hydroxy-3-phenyl-, 587².
- C₁₄H₁₁N₂O₂ Acetanilide, *o*-(*p*-nitrophenyl)-, 1260¹.
Benzaldehyde, *O*-*p*-nitrobenzoyloxime, 2257².
3-Isophenoxazone, 9-dimethylamino-4-hydroxy-, 743².
Isophthalaldehydic acid, 4-hydroxy-, phenylhydrazone, 1980².
- C₁₄H₁₁N₂O₂S Benzenesulfenic acid, 2-(α -methyliminobenzyl)-4-nitro-(?), 2693².
- C₁₄H₁₁N₂O₂ Anthranilic acid, nitrophenyl-, Me ester, 232².
- C₁₄H₁₁N₂O₂S₂ Benzisulfonazolate, 1,2-dihydro-2-tolylsulfonylimino-, 2888².
Disulfide, bis(6-nitro- α -tolyl), 1985².
- C₁₄H₁₁N₂O₂ Benzohydrol, α -dinitromethyl-, 52².
Ether, 2,6-dinitro-*p*-tolyl *p*-tolyl, 1253².
—, bis(2-nitro-*p*-tolyl), 1253².

- $C_{11}H_{12}N_2O_8S_2$ Disulfide, *p*-acetamidophenylsulfon-*o*-nitrophenyl, 2885⁷.
- $C_{11}H_{12}N_2O_8S_2$ 2,2'-Tolandisulfonic acid, 4,4'-diamino-, 909².
- $C_{11}H_{12}N_2O_{11}S_2$ *m*-Toluenesulfonic anhydride, 6,6'-dihydroxy-5,5'-dinitro-, 3897².
- $C_{11}H_{12}N_2S_2$ Benzothiazole, 1-(aminophenyl)-methyl-, 1985⁴.
- $C_{11}H_{12}N_4$ 1,2,3-Benzotriazole, 5-benzalamino-1-methyl-, 2689⁹.
Ethylene, *s*-bis(phenylazo)-, 1972⁸.
- $C_{11}H_{12}N_4O$ Pseudoisatin, 6-amino-, phenylhydrazone, 912⁴.
- $C_{11}H_{12}N_4O_2$ 1,2,3-Benzotriazole, 4,7-dimethyl-5-nitro-1-phenyl-, 2600².
Dinitrotonitrile, 4-benzyl-2,5-dihydro-6-hydroxy-2-keto-, NH_4 deriv., 228⁷.
1,2,4-Triazole, 3,5-dimethyl-1-(nitronaphthyl)-, 3200⁹.
- $C_{11}H_{12}N_4O_6$ Benzaldehyde, methoxydinitro-, phenylhydrazone, 2675⁴.
- $C_{11}H_{12}N_4S_2$ 1,3,4-Triazole-2-mercaptan, 5-anilino-1-phenyl-, 2900⁵.
- $C_{11}H_{12}N_4O_8$ Oxalic acid, bis(*o*-nitrophenylhydrazide), 2133³.
- $C_{11}H_{12}O$ Acetaldehyde, diphenyl-, 2126⁵.
1(2)-Anthracene, 3,4-dihydro-, 1123¹.
Benzophenone, *p*-methyl-, 3616¹.
 Δ^2 -2-Butenone, 4-naphthyl-, 97².
Desoxybenzoin, 2126⁵.
9-Fluorenone, 9-methyl-, 3902⁷.
- $C_{11}H_{12}OS_2$ 1,3-Benzodithiole, 2-*p*-anisyl-, 1985¹.
- $C_{11}H_{12}O_2$ (See also *Benzoic*.)
Acetic acid, diphenyl-, 947⁵.
Benzoic acid, benzyl ester, 55¹; tolyl ester, 1642².
Benzophenone, 4-hydroxy-3-methyl-, 1645⁴.
—, methoxy, 811².
Phthalide, 4,5-dihydro-2-phenyl-, 2262³.
 α , α' -Stilbene-1,3-diol, 3902³.
- $C_{11}H_{12}O_3$ Benzoic acid, 3296⁸.
Benzoic acid, *o* (*o*-anisyl)-, 2266⁴.
3,4- α -Naphthofurandione, 1,2-dihydro-1,2-dimethyl-, 1457⁵.
Naphthopyrandione, 3,4-dihydro-2-methyl-, 1457⁴.
Naphthoquinone, 2- Δ^2 -butenyl-3-hydroxy-, 1457⁴.
—, Δ^2 -butenyloxy-, 1457⁴.
—, 2-hydroxy-3-(α methylallyl)-, 1457⁵.
Phenol, 4-methoxy-, benzoate, 1253⁸.
Salicylic acid, benzyl ester, 2430⁴.
- $C_{11}H_{12}O_4$ Acetic acid, diphenoxy-, 1642¹.
Cotoin, 2256⁷.
Isocotoin, 2256⁷.
1,4-Pyran-2-carboxylic acid, 4-keto-6-phenyl-, Et ester, 2901⁹.
- $C_{11}H_{12}O_5$ Isomethysticinic acid, 2125⁸.
Methysticinic acid, 2125⁸.
Phloracetophenone, α -(*p*-hydroxyphenyl)-, 246¹.
- $C_{11}H_{12}AsOS_2$ 6-Ethylphenoxarsonium sulfide, 1654¹.
- $C_{11}H_{12}AsO_4$ Dibenzoarsenic acid, 2,8-dimethoxy-, 905³.
- $C_{11}H_{12}AsNO_2$ Acetanilide, *p*-(*p*-hydroxyphenylarseno)-, P 745².
- $C_{11}H_{12}BrClN$ Dibenzylamine, *p*-bromo-*p*-chloro-, and - HCl , 53⁹.
- $C_{11}H_{12}BrIN$ Dibenzylamine, *p*-bromo-*p*-iodo-, and - HCl , 53⁹.
- $C_{11}H_{12}BrN_2O_2$ Vanillin, 5-bromo-, phenylhydrazone, 2258⁴.
- $C_{11}H_{12}ClN_2O_2$ Vanillin, chloro-, phenylhydrazone, 906².
- $C_{11}H_{12}ClN_2O_8$ Dye from phenoxazinesulfonic acid deriv., 3024⁴.
- $C_{11}H_{12}ClN_4O_2$ Benzylamine, *p*-chloro-*N*-methyl-, picrate, 53⁹.
- $C_{11}H_{12}ClO_2$ *m*,*m'*-Bianisole, 6-chloro-, 905².
- $C_{11}H_{12}Cl_2N$ Dibenzylaniline, dichloro-, 53⁹; - HCl , 541².
- $C_{11}H_{12}IN_2$ 1,4-Imidazopyridine, 2-phenyl-, methiodide, 246⁸.
- $C_{11}H_{12}LnN_2O_2$ Cyclopentanecarboxylic acid, 2-keto-1-(3,4,5-triiodophenylazo)-, Et ester 90⁶.
- $C_{11}H_{12}N$ Benzisoquinoline, dihydromethyl-, 972².
Carbazole, 2,4-dimethyl-, 230⁶.
Methylamine, *N*-diphenylmethylene-, 3901⁴.
- $C_{11}H_{12}NO$ Acetanilide, *o*-phenyl-, 1259⁹.
Aniline, *N*-anisal, 2669⁴.
—, *N*-*o*(and *m*)-methoxybenzal-, 2669⁴.
p-Anisidine, *N*-benzal-, 2692².
1(2)-Anthracenone, 3,4-dihydro-, oxime, 1123¹.
Benzimidic acid, *N*-methyl-, Ph ester, 3190³.
 Δ^2 -2-Butenone, 4-naphthyl-, oxime, 97².
Nitrene, phenyl-*p* tolyl-, 3895⁸.
Phthalimidine, 5,6-dihydro-2-phenyl-, 2678⁴.
 α -Tolimidic acid, Ph ester, - HCl , 1256⁹.
- $C_{11}H_{12}NOS$ *p*-Benzanilide, thio-, 2692¹.
- $C_{11}H_{12}NO_2$ Acetoacetamide, *N*-naphthyl-, 96⁸.
Benzoin, oxime, 2430⁶.
Benzophenone, *o*-methoxy-, oxime, 3347¹.
2,3-Cresotanilide, 2800⁸.
Glycolaldehyde, diphenyl-, oxime, 3356¹.
Ketone, β -aminopropenyl hydroxy-2-naphthyl-, 2472³.
- $C_{11}H_{12}NO_3$ Acetamide, *N*-(7-hydroxy-2-naphthyl)-, acetate, 909⁹.
Benzohydrol, α -nitromethyl-, 52⁸.
Ether, 2-nitro-*p*-tolyl *p*-tolyl, 1253⁹.
Ether, 3-nitro-*p*-tolyl *p*-tolyl, 2885¹.
Ketone, 2-hydroxy-1-naphthyl methyl, acetyloxime, 3364¹.
1-Naphthaldehyde, 2(and 4)-methoxy-, oxime, Ac deriv., 3618⁷.
5-Quinolineacrylic acid, 6-hydroxy-, Et ester, 3197⁷.
- $C_{11}H_{12}NO_3S$ 2-Benzisosulfonazolol, 2-benzyl-1,2-dihydro-, 3202⁷.
- $C_{11}H_{12}NO_4S_2$ Disulfide, 5-methyl-*o*-anisylsulfon-*o*-nitrophenyl, 2885⁷.
- $C_{11}H_{12}N_2$ Benzimidazole, 5-amino-1-*p*-tolyl-, 2691².
1,2,4-Triazole, 3,5-dimethyl-1-naphthyl-, and salts, 3201¹.
- $C_{11}H_{12}N_2O_2$ Acetanilide, α -(*N*-nitrosoanilino)-, 1801¹.
Acetanilide, *p*-phenylazoxy-, 2466⁴.
Carbanilide, *o*-formyl-, oxime, 1119⁴.
Glyoxylohydroxamanilide, α -phenyl-, oxime, 1098⁹.
- $C_{11}H_{12}N_2O_3$ Indazole, tetrahydronitrobenzoyl-, 2900¹.
Isoindazole, tetrahydronitrobenzoyl-, 2899⁹, 2900¹.
 α -Tolualdehyde, *o*-hydroxy-, *p*-nitrophenylhydrazone, 2875¹.
 α -Tolamide, α -anilino-*m*-nitro-, and - H_2SO_4 2125².
- $C_{11}H_{12}N_2O_4$ Acetophenone, 3,5-dihydroxy-, *p*-nitrophenylhydrazone, 1803⁸.
Benzaldehyde, 8-hydroxy-5-methoxy-, *p*-nitrophenylhydrazone, 3356¹.

- Benzylamine, *N* - (2,4 - dinitrophenyl) - α - methyl-, 405¹.
- Xenylamine, *N*, *N*-dimethyl-2,4' (and 3,4')-dinitro-, 238¹.
- 2,5-Xyldine, 4,6-dinitro-*N*-phenyl-, 2690².
- C₁₄H₁₃N₃O₃ Acetophenone, 3,4,5-trihydroxy-, *p*-nitrophenylhydrazone, 1108¹.
- C₁₄H₁₃N₃O₄ 1,2,5-Triazole-3,4-dicarboxylic acid, 1-(*p*-carboxyphenyl)-, tri-Me ester, 2690².
- C₁₄H₁₃N₃O₅ See *Asure A*.
- C₁₄H₁₃N₃O₃ Acetanilide, α -amino-, picrate, 3355².
- C₁₄H₁₄ Bibenzyl, 1060⁶, 3047⁵.
- C₁₄H₁₄AsN Phenarsazine, 1-ethyl-1,6-dihydro-, 1654¹.
- C₁₄H₁₄AsNO₄ Arsanilic acid, *N*-*p*-toluyl-, 3612⁵.
- C₁₄H₁₄AsN₂O₃ See *Sulfarsphenamine*.
- C₁₄H₁₄AsN₂O₄ Acetanilide, 5-(*p*-aminophenylarseno)-2-hydroxy-, P 745².
- C₁₄H₁₄AsN₂O₅ Acetanilide, 5-(3-amino-4-hydroxyphenylarseno)-2-hydroxy-, P 745².
- C₁₄H₁₄BrN Xenylamine, 2(?) - bromo-*N*, *N*-dimethyl-, 1109¹.
- C₁₄H₁₄BrN₂ Aniline, 3-bromo-*N*, *N*-dimethyl-(phenylazo)-, 903².
- C₁₄H₁₄BrN₂O₂ Vanillin, 2-amino-, *p*-bromophenylhydrazone, 1803⁸.
- C₁₄H₁₄Br₂N₂ Hydrazine, *as*-bis(*o*-bromobenzyl)-, -HCl, 2685⁹.
- C₁₄H₁₄Br₂N₂O₃ Succinic acid, diketo-, diethyl ester, mono(2,4-dibromophenyl)hydrazone, 2890⁹.
- C₁₄H₁₄Br₂O₄ Caproic acid, δ , ϵ -dibromo- α , γ -diketo- ϵ -phenyl-, ethyl ester, 2901⁸.
- C₁₄H₁₄Br₂N₂S β -Naphthothiazole, 2-propylamino-, hexabromide, 584⁷.
- C₁₄H₁₄ClN Dibenzylamine, *p*-chloro-, and -HCl, 53⁹.
- Di-*o*-tolylamine, 4-chloro-, P 1273³.
- C₁₄H₁₄Cl₂O₄ β -Cumidic acid, α , α , α' , α' -tetrachloro-, di-Et ester, 3897⁷.
- C₁₄H₁₄Ge₂O₃ Germanoformic anhydride, dibenzyl-, 3897⁷.
- Germanoformic anhydride, di-*p* tolyl-, 3897⁷.
- C₁₄H₁₄HgN₂O₂ Benzidine, 3-(acetoxymercuri)-, and di-HCl, 2255⁵.
- C₁₄H₁₄HgN₂O₃ Pyridine, 3,3'-mercuribis[6-acetamido-(?)], 1814⁸.
- C₁₄H₁₄HgO₄S *o*-Cresol, 4 (and 6)-(hydroxymercuri)-, sulfate, 1253².
- C₁₄H₁₄N₂ Quinazoline, 5,6,7,8-tetrahydro-2-phenyl-, 3198⁷.
- C₁₄H₁₄N₂O Acetanilide, aminophenyl-, 237⁸, 2473⁴.
- Acetanilide, α -anilino-, and salts, 1801^{3,2}.
- Acetohydroxamamide, α , α -diphenyl-, 52⁷.
- p*-Benzohydroxamotoluide, 1106⁹.
- Cresol, tolylazo-, 3895⁹.
- Indazole, benzoyltetrahydro-, 2900¹.
- Isolindazole, benzoyltetrahydro-, 2900¹.
- 4-Quinazolinol, 5,6,7,8-tetrahydro-2-phenyl-, 3198⁷.
- C₁₄H₁₄N₂O₂ Anthranilic acid, *N*-(*p*-aminophenyl)-, Me ester, 232⁸.
- Benzoic acid, 5-amino-2-anilino-, Me ester, 232⁸.
- Benzylamine, α -nitromethyl-*N*-phenyl-, and salts, 2253⁹.
- 3(2) - Cinnolone, 5,6,7,8 - tetrahydro - 4 - hydroxy-2-phenyl-, 2899⁹.
- Compd., m. 221⁹, from 2-(*p*-nitrobenzyl)-pyridine and NaOEt, 93⁹.
- 3-Indazolecarboxylic acid, 4,5,6,7-tetrahydro-2-phenyl-, 2899⁹.
- 3-Isolindazolecarboxylic acid, 4,5,6,7-tetrahydro-1-phenyl-, 2899⁹.
- 5-Pyrazolecarboxylic acid, 3-styryl-, ethyl ester, 2901⁹.
- Xenylamine, *N*, *N*-dimethylnitro-, 237⁷, 238¹.
- C₁₄H₁₄N₂O₂ Anisole, *p*, *p'*-azoxybis-, 843⁸, 1920⁴, 3538².
- Benzyl alcohol, *o*, *o'* (and *p*, *p'*)-azoxybis-, 572⁹, 573¹.
- 3-Pyranquinolone, 7,8,9,10-tetrahydro-8,10-dimethyl-7-nitroso-, 411².
- m*-Toluidine, 5-nitro-6-*p*-toloxy-, and -HCl, 2885².
- C₁₄H₁₄N₂O₂ 1,2,9,10-Anthrattetrol, 9,10-diamino-9,10-dihydro-, 2904².
- C₁₄H₁₄N₂O₃ Sufanilic acid, *N*-(phenylcarbonylmethyl)-, Na salt, 1801³.
- p*-Toluenesulfonanilide, *N*-methyl-2'-nitro-, 2680⁹.
- C₁₄H₁₄N₂O₃ Barbituric acid, 5-ethyl-5-piperonyl-, 2251¹.
- C₁₄H₁₄N₂O₃ *m*-Toluenesulfono-*p*-toluide, 6-hydroxy-5-nitro-, 3897².
- C₁₄H₁₄N₂S Carbanilide, *o*-methylthio-, 671⁴.
- β -Naphthothiazole, 2-propylamino-, 584⁷.
- C₁₄H₁₄N₄ 1,2,3-Benzotriazole, 5-amino-4,7-dimethyl-1-phenyl-, 2690².
- C₁₄H₁₄N₄O Benzophenone, 4-aminosemicarbazone, 1149¹.
- Hydrazobenzene, *N*,3 (and *N*,5)-dimethyl-2,6 (and 2,4)-dinitro-, 395⁸.
- C₁₄H₁₄N₄O₂ Carbamic acid, (2,3,4,5-tetrahydro-3,5-diketo-2-*p*-tolyl-6-*as*-triazinylformyl)-, Et ester, 1654⁴.
- C₁₄H₁₄N₄O₂ 2-Naphthylamine, *N*-butyl-1,6,8-trinitro-, 404⁴.
- 2-Naphthylamine, *N*, *N*-diethyl-1,6,8-trinitro-, 404⁴.
- , *N*-isobutyl-1,6,8-trinitro-, 404⁴.
- C₁₄H₁₄N₄S Biurea, β , β' -diphenylidithio-, 2901³.
- C₁₄H₁₄N₄O₂ Hydrazine, α -ethyl- α' -(*p*-nitrophenyl)-, picrate, 1251³.
- C₁₄H₁₄N₄O₂ Biurea, β , β' -bis(phenylazo)-, 2903⁷.
- C₁₄H₁₄N₄O₂Pb Δ^1 -Isouric acid, 7,9-dimethyl-, Pb deriv., 3353⁴.
- C₁₄H₁₄N₄S₂ Disulfide, from *o*-phenylenethiocarbonylhydrazide, 2133¹.
- C₁₄H₁₄O Benzyl ether, 55⁷, 737⁸.
- 2-Butanone, 4-naphthyl-, 97².
- p*-Tolyl ether, 1253³.
- C₁₄H₁₄O Δ^1 -Cyclohexenecarboxylic acid, 6- α -hydroxybenzyl-, lactone, 2262⁹.
- Ethanediol, diphenyl-, P 3137⁸.
- Furan, 2-(γ -phenylallyloxymethyl)-, 1648⁴.
- Hydrobenzoin, 2254³.
- 2-Naphthoic acid, 4,6-dimethyl-, Me ester, 1646⁹.
- 1,4 - Naphthoquinone, isopropylmethyl-, 2123⁹.
- Δ^1 ,2,4-Octadienedione, 8-phenyl-, 2468⁹.
- C₁₄H₁₄O Δ^1 -Cyclohexenecarboxylic acid, 6-benzoyl-, and Ag salt, 2262⁹.
- 7, ϵ -Heptadienic acid, β -keto-*f*-phenyl-, Me ester, 2468⁹.
- Naphthoquinone, butoxy-, 83⁹.
- C₁₄H₁₄O₂ Nodakenetin, 1817⁹.
- C₁₄H₁₄O₂ Quinide, benzoyl-, 2701³.
- C₁₄H₁₄O₂ Benzenesulfonic acid, ethylene ester, 1802⁷.
- C₁₄H₁₄O₂ Acetophenone, 3,4,5-trihydroxy-, triacetate, 1108¹.

- C₁₄H₁₆O₈** 1,2,4,5-Benzenetetrol, tetraacetate, 3605^a.
- C₁₄H₁₆O₈** Glutaric acid, α -(β , β' -dihydroxyisopropylidene) - β , β - bis(hydroxymethyl)- γ -keto-, di- γ -lactone, diacetate, 896^a.
- C₁₄H₁₆Se** *o*-Tolyl selenide, 1253^a.
- C₁₄H₁₆AsN** 1,6-Dihydro-1,1-dimethyl-1-phenarsazonium iodide, 1654¹.
- C₁₄H₁₆AsO₃** Arsinic acid, dibenzyl-, 3612^a.
- C₁₄H₁₆ClO₃** Isobutyrophenone, 5-chloro- α ,2-dihydroxy-, diacetate, 1117^a.
- C₁₄H₁₆N** Benzohydrylamine, *p*-methyl-, and -HCl, 3346^a.
- Benzoquinoline, tetrahydromethyl-, 97¹; and salts, 967^a.
- Dibenzylamine, 73^a.
- Diethylamine, P 1273^a.
- Ethylamine, β , β -diphenyl-, and salts, 52^a.
- Xenylamine, *N*, *N*-dimethyl-, 237^a.
- C₁₄H₁₆NO** Benzohydrol, α -(aminomethyl)-, 507^a.
- Benzohydrylamine, *o*-(and *p*)-methoxy-, and salts, 3346^a.
- 2-Butanone, 4-naphthyl-, oxime, 97¹.
- Ethanol, 2-amino-1,2-diphenyl-, and salts, 2254¹.
- Hydroxylamine, α - benzyl - β - methyl - β - phenyl-, 65^a.
- Ketone, phenyl 2,4,5-trimethyl-3-pyrryl, 382^a.
- Phthalimide, 3a,4,5,6 - tetrahydro - 2 - phenyl-, 2677^a.
- Toluidine, toloxy-, and salts, 2885¹.
- C₁₄H₁₆NO₂** Condensation product of PhOH and CH₂O, 1335^a.
- β , δ -Hexadienic acid, α -(ethylimino) ϵ -phenyl-, 2882^a.
- 3 - Pyranquinoline, 7,8,9,10 - tetrahydro-8,10-dimethyl-, 411¹.
- C₁₄H₁₆NO₂S** Ethanesulfonanilide, 2-phenyl-, 2673^a.
- α -Toluenesulfonanilide, *N*-methyl-, 99^a.
- α -Toluenesulfonotoluide, 99^a.
- C₁₄H₁₆NO₂S** α -Toluenesulfonanilide, 99^a.
- C₁₄H₁₆NO₄** 3-Quinaldicarboxylic acid, 4-hydroxy-6,7,8-trimethoxy-, 912^a.
- C₁₄H₁₆NO₄S** Ditoluenesulfonamide, dihydroxy-, 3605^a.
- C₁₄H₁₆N₂** Aniline, *N*, *N*-dimethyl-*p*-phenylazo-, 687.
- Guanidine, phenyl-*o*-tolyl-, 672^a.
- C₁₄H₁₆N₂O** (See also *Trypafavine*.)
- Guanidine, α -*p*-anisyl- γ -phenyl-, 1463^a.
- C₁₄H₁₆N₂O₂** Benzoic acid, 5-amino-2-(aminoanilino)-, Me ester, 232^a.
- Benzoic acid, 3,5-diamino-2-anilino-, Me ester, 2269^a.
- Hydrazine, α - (α - nitromethylbenzyl) - β - phenyl-, and salts, 2253^a.
- o*-Phenylenediamine, 3,6-dimethyl-4-nitro-*N*¹-phenyl-, 2690^a.
- C₁₄H₁₆N₂O₂S** sodium salt—see *Methyl orange*.
- C₁₄H₁₆N₂O₄** 1,2,5-Triazole-3,4-dicarboxylic acid, 1-phenyl-, di-Et ester, 2269¹.
- C₁₄H₁₆N₂O₄** Cyclopentanecarboxylic acid, 2-keto-1-(*p*-nitrophenylazo)-, Et ester, 90^a.
- C₁₄H₁₆N₂O₄S** Azo dye from Et 2-methyl-3-pyrrolecarboxylate and diazobenzenesulfonic acid, 381^a.
- C₁₄H₁₆N₂O₆** Nitro deriv., *m*. 98-99°, of the hydrazine from di-Et xanthophanate, 1266^a.
- C₁₄H₁₆N₂S** Semicarbazide, 2-phenylthio-4-m-tolyl-, 3200^a.
- C₁₄H₁₆N₂O₄** Glyoxime, diacetyl-, peroxide, acetoxyimino, phenylhydrazone, 1099¹.
- C₁₄H₁₆N₂O₄** Pyrrole, 2-(iminomethyl)-3,4,5-trimethyl-, picrate, 85^a.
- C₁₄H₁₆OP** Phosphine oxide, benzylmethylphenyl-, 669¹.
- C₁₄H₁₆** Naphthalene, isopropylmethyl-, 2123¹.
- C₁₄H₁₆As₂N₂O₂S₂** Methanesulfonic acid, 5,5'-arsenobis[2-hydroxyanilino-(?)], P 916^a.
- C₁₄H₁₆BrNO** Carbazole, acetylhexahydro-, and -HBr, 2898^a.
- C₁₄H₁₆BrNO₂** Salicylamide, bromoisovaleryl-, acetate, 1866^a.
- C₁₄H₁₆BrN₂** Isopyrrole, 2-(5-bromo-3,4-dimethyl-2-pyrrolylmethylene) - 5 - (bromomethyl) - 3,4-dimethyl-, -HBr, 86¹.
- C₁₄H₁₆BrN₂O** Pseudocumenol, 3,6-dibromo- α' -(3,5-dimethyl-1-pyrazolyl)-, 903^a.
- C₁₄H₁₆ClNO** Benzylhydroxymethylphenylammonium chloride, 65^a.
- C₁₄H₁₆Cl₂O₄** β -Cumidic acid, α , α' dichloro-, di-Et ester, 3897^a.
- C₁₄H₁₆CoN₂O₄** Addn. compd. of Co(C₂H₃O₂)₂ and pyridine, 1235¹.
- C₁₄H₁₆INO₂** 7,8,9,10-Tetrahydro-3-keto-7,8-dimethylpyranoquinolinium iodide, 411¹.
- C₁₄H₁₆N₂** 2,2'-Bi-*m*-toluidine, 2892^a.
- Hydrazine, *as*-dibenzyl-, -HCl, 2686¹.
- o*-Tolidine, 2891^a.
- C₁₄H₁₆N₂O₂** Anisole, *o*,*o'*-hydrazobis-, 3611¹.
- o*-Tolnic acid, 4,5-dihydro- α -hydroxy-, β phenylhydrazide, 2678^a.
- C₁₄H₁₆N₂O₃** Carbazole, acetylhexahydronitro-, 2898¹.
- Cyclopentanecarboxylic acid, 2-keto-1-phenylazo-, Et ester, 90^a.
- 1-Pyrazolidinealdehyde, 4,4-diethyl-3,5-diketo-2-phenyl-, 1329¹.
- Spiro[cyclohexane-1,2'-pseudoinodoxyl], 1'-methyl-5'-nitro-, 2882^a.
- C₁₄H₁₆N₂O₄** Acetoacetamide, phenylenebis-, P 2805¹.
- Barbituric acid, 5-ethyl-5-*p*-methoxybenzyl-, 2251^a.
- Et deriv., *m*. 75-6°, of hydrazine from di-Et xanthophanate, 1266^a.
- 2-Piperazinepropionic acid, 5-benzyl-3,6-diketo-, 61^a.
- 2-Pyrroleacrylic acid, 4-carboxy- α -cyano-5-methyl-, di-Et ester, 381^a.
- 2-Pyrrolidinedicarboxylic acid, 5-keto-1-salicylalamino-, ethyl ester, 2897^a.
- C₁₄H₁₆N₂O₄S₂Zn**, 3171¹.
- C₁₄H₁₆N₂O₄S₂Zn** Benzenesulfonic acid, xylidine salt, 1104¹.
- Benzylamine, *o*-nitro-, *p*-toluenesulfonate, 75^a.
- C₁₄H₁₆N₂O₇** 2-Furanpropanol, tetrahydro-, 3,5-dinitrobenzoate, 3053^a.
- C₁₄H₁₆N₂S** Urea, α -1-naphthyl- β -propylthio-, 584^a.
- C₁₄H₁₆N₂S₂** Toluidine, dithiobis-, 234^a, 1985¹.
- C₁₄H₁₆N₂S₂Zn** *o*-Tolyl mercaptan, 6-amino-, Zn deriv., 1985¹.
- C₁₄H₁₆N₂O** Pseudoscopine, picrate, 3365^a.
- C₁₄H₁₆O** 7(8)-Cycloheptanaphthenone, 1,2,3,9,10,10a-hexahydro-, 2684^a.
- 2-Naphthol, 7-ethyl-1,4-dimethyl-, 1126^a.
- C₁₄H₁₆O₂** Acrylic acid, α -benzoyl- β -ethoxy-, Et ester, 1266¹.
- Malonic acid, β -1-indanylethyl-, 2684¹.
- C₁₄H₁₆O₂** Malonic acid, α -(α -formylisopropyl)-benzyl-, 3044¹.
- C₁₄H₁₆Si** Silicane, dimethyldiphenyl-, 1251¹.

- C₁₄H₁₆Sn Stannane, dimethyldiphenyl-, 1973⁷.
- C₁₄H₁₇BrN₂ Isopyrrole, 2-(5-bromo-3,4-dimethyl-2-pyrrolylmethylene)-3,4,5-trimethyl-, and -HBr, 86¹.
- C₁₄H₁₇ClO 1-Naphthalenebutyryl chloride, 1,2,-3,4-tetrahydro-, 2684⁴.
- C₁₄H₁₇N Carbazole, 1,2,3,4-tetrahydro-2,4-dimethyl-, 230^{6,8}.
- C₁₄H₁₇NO Acenaphthene, 3-acetamido-1,2,3,8a-tetrahydro-, 84⁴.
- 7(8)-Cycloheptanaphthenone, 1,2,3,9,10,-10a-hexahydro-, oxime, 2684⁴.
- Δ¹(α)-Cyclohexanacetanilide, 3186⁴.
- Ketone, isobutenyl 6-isobutenyl-3-pyridyl, and HgCl₂ compd., 2130⁴.
- α-Toluamide, α,α-diallyl-, 2758⁴.
- C₁₄H₁₇NO₂ Δ²-Cyclohexenone, 5-anilino-4-hydroxy-2,4-dimethyl-(?), 2124⁴.
- C₁₄H₁₇NO₂S Benzylamine, *p*-toluenesulfonate, 75⁴.
- C₁₄H₁₇NO₄ Cyclohexanol, methyl-, *p*-nitrobenzoate, 374^{4,7,8}, 375².
- 2,5-Pyrrolidinedicarboxylic acid, 1-*p*-methylbenzyl-, 412⁴.
- Tyrosine, *N*-isopropylidene-(?), acetate, 3900⁴.
- C₁₄H₁₇NO₄S Ethylsulfuric acid, Ph₂NH salt, 53².
- C₁₄H₁₇NO₄ Indican, 3602².
- 4-Quinoluiol, 2-ethoxy-6,7,8-trimethoxy-, *N*-oxide, 912¹.
- C₁₄H₁₇NO₈ Acetic acid, (3,4,5-trimethoxy-2-nitrobenzoyl)-, Et ester, 911¹.
- C₁₄H₁₇NO₁₇ See *Apolysin*.
- C₁₄H₁₇N₂ Pyrrole, butylphenylazo-, 2451³.
- C₁₄H₁₇N₂O 1-Benzonaphthenone, 2,3,3a,4,5,6-hexahydro-, semicarbazone, 84⁵.
- Homotetraphene ketone, semicarbazone, 2684⁴.
- 2-Indenealdehyde, 1,3,5-trimethyl-(?), semicarbazone, 910⁴.
- C₁₄H₁₇N₂OS 2,4-Thiazolodione, 5-ethyl-3-phenyl-, isopropylidenehydrazone, 245⁷.
- C₁₄H₁₇N₂O₂ Isonitroso deriv., m. 183², of base from BzCH₂CN and piperidine, and -HCl, 2902⁴.
- 2,5-Piperazinedione, 1,4-dimethyl-, indole addn. compd., 1797².
- C₁₄H₁₇N₂O₂ 2,5-Piperazinedione, 1,4-dimethyl-, oxindole addn. compd., 1797².
- C₁₄H₁₇N₂O₂S Compd., m. 215-7², from *N,N*-dimethylxenylamine, 238².
- C₁₄H₁₇N₂O₄ 1,2,5-Triazole-3,4-dicarbamic acid, 1-phenyl-, di-Et ester, 2690⁴.
- C₁₄H₁₇N₂O₄ Guanidine, α-allyl-, picolonate, 62².
- C₁₄H₁₈ 1,5-Heptadiene, 6-methyl-2-phenyl-, 50⁷.
- Hydrocarbon, m. 53², from tetrahydro-2,2,5-trimethyl-5-*p*-tolylfuran, 910⁸.
- C₁₄H₁₈ClN₂O₇ Arsanilic acid, *N*-(*N*-[*N*-(4-chloroacetyl)glycyl]glycyl]glycyl)-, 71¹.
- C₁₄H₁₈BeCl₂N₂ Addn. compd. from *o*-toluidine and BeCl₂, 1601⁴.
- C₁₄H₁₈BrN₂O₂S Thiophene, tetrahydro-, 1-δ-bromobutyl picrate, 1639².
- C₁₄H₁₈Br₂N₂O₂ 2,6-*p*-Cymenediamine, *N,N'*-diacetyl-3,5-dibromo-, 903⁴.
- C₁₄H₁₈Cl₂N₂O₂ Butyramide, *N,N'*-*o*-phenylenebis(β-chloro-, 1979⁷.
- C₁₄H₁₈HgO₂ Salicylaldehyde, 3-(acetoxymercuri)-5-isoamyl-, 69².
- C₁₄H₁₈Hg₂O₂ Carvacrol, 3,5-bis(acetoxymercuri)-, 69².
- Phenol, 2,6-bis(acetoxymercuri)-4-*tert*-butyl-, 69².
- C₁₄H₁₈N₂ Isopyrrole, 3,5-dimethyl-2-(3,4,5-trimethyl-2-pyrrolylmethylene)-, and salts, 85⁴.
- Putrescine, *N*-2-naphthyl-, P 916².
- C₁₄H₁₈N₂O Base, m. 173², from BzCH₂CN and piperidine, and salts, 2902⁴.
- C₁₄H₁₈N₂O₂ Carbazole, ethylhexahydronitro-, 2898⁴.
- Compd., m. 122², from 4-ethyl-3,5-dimethyl-2-pyrrolealdehyde, 2701⁸.
- Δ¹-Cyclohexenecarboxylic acid, (hydroxymethyl)-(?), phenylhydrazide, 2677⁸, 2678⁸.
- 1,10-Phenanthroline-2,9(1,10)-dione, 3,4,7,-8-tetrahydro-4,7-dimethyl-, 1979⁸.
- Quinoxaline, 1,4-diacetyl-1,2,3,4-tetrahydro-2,3-dimethyl-, 1653⁹.
- C₁₄H₁₈N₂O₄ Adipic acid, α-keto-, mono-Et ester, phenylhydrazone, 90².
- Benzoic acid, nitro(1-piperidyl)-, Et ester, 2681⁴.
- Compd. from enzymic cleavage of casein, 256².
- Cyclopentanetriole, 1-[3,4(and 3,5)-dimethoxyanilino]-, 1635⁷.
- 1-Piperidineethanol, *p*-nitrobenzoate, -HCl, 1977⁸.
- C₁₄H₁₈N₂O₆ Glutamic acid, *N*-(β-phenylalanyl)-, 613⁴.
- p*-Phenylenediamine, *N,N,N'*-triacetyl 2,3-dimethoxy-, 376².
- C₁₄H₁₈N₂O₂S 2-Naphthol-3,6-disulfonamide, *N,N,N',N'* tetramethyl, 3605².
- C₁₄H₁₈N₂O₆ Malonic acid, (α-amino-*m*-nitrobenzyl)-, di-Et ester, -HCl, 1978³.
- C₁₄H₁₈N₂O₄ Glycine, *N*-(β-formylstyryl)-, Et ester, semicarbazone, 2259⁴.
- C₁₄H₁₈N₂O₄S 4(or 5)-Imidazolecarboxylic acid, 2,2'-dithiobis[5(or 4)-methyl-, di-Et ester, 3615¹.
- C₁₄H₁₈O Ether, allyl 6-propenyl-2,4-xylyl, 71².
- Δ⁴-2-Hexenone, 3-ethyl-4-phenyl-, 229⁷.
- 2,4-Xylenol, 6-(β-methylpentadienyl)-, 71².
- C₁₄H₁₈O₂ Cinnamic acid, β propyl-, Et ester, 220².
- Hydrocinnamic acid, α allyl-*p*-methyl-, Me ester, 1646².
- Hydrosoibic acid, β-phenyl-, Et ester, 229².
- 1-Naphthalenebutyric acid, 1,2,3,4-tetrahydro-, 2683².
- 2-Naphthoic acid, 1,2,3,4-tetrahydro-4,6-dimethyl-, Me ester, 1646².
- C₁₄H₁₈O₂ Phthalic acid, dithiol, di-Pr ester, 3192².
- C₁₄H₁₈O₂ Δ²-2-Butenone, 4-(4 isopropoxy-*m*-anisyl)-, 3612².
- Δ³ - 2 - Butenone, 4 - (4 - propoxy - *m* - anisyl)-, 3612².
- Δ¹-3-Heptenone, 1-(4-hydroxy-*m*-anisyl)-, 3615².
- Hydrocinnamic acid, β-(β,β-dihydroxy-*tert*-butyl)-α-methyl-, lactone, 3044².
- , β-(α-formylisopropyl)-, Me ester, 3044².
- , β-(β-hydroxy-β-methoxy-*tert*-butyl)-, lactone, 3044².
- Isobutyrophenone, hydroxydimethyl-, acetate, 1117², 3611⁷.
- Ketone, cyclohexylmethyl 2,4-dihydroxyphenyl-, 3050⁴.

- C₁₄H₁₅O₈ 2, 5-Cresotic acid, *d*-glucosido-, 1106².
Vanillin, glucoside, 1290².
- C₁₄H₁₅BrN₂O₂ 2, 6-*p*-Cymenediamine, *N*, *N'*-diacetyl-3-bromo-, 903².
Ethylidimethyl(β - phthalimidoethyl)ammonium bromide, 2660⁶.
- C₁₄H₁₅BrN₂S Benzothiazole, 5-bromo-1-heptylamino-, 584⁷.
- C₁₄H₁₅BrN₂S Benzothiazole, 5-bromo-1-heptylamino-, dibromide, 584⁷.
- C₁₄H₁₅N Indole, 2-hexyl-, 1262².
- C₁₄H₁₅NO Morphopyrrolidine, *N*-*p*-methylbenzyl-, 412⁷.
Propiophenone, β-1-piperidyl-, -HCl, 1121⁵.
α-Tolamide, α-allyl-α-propyl-, 2758⁹.
- C₁₄H₁₅NOS Homoanisic acid, thiono-, piperidine, 2669⁴.
- C₁₄H₁₅NO₂ Benzamide, *N*, *N*-diethyl-*o*(*m* and *p*)-propionyl-, 1980^{7, 8}.
Cyclohexanol, methyl-, carbanilate, 374^{9, 7, 8}.
- C₁₄H₁₅NO₂ Hydrocinnamic acid, β-(α-formylisopropyl)-α-methyl-, oxime, 3044⁵.
- C₁₄H₁₅NO₄ Malonic acid, (α-aminobenzyl)-, di-Et ester, -HCl, 1978³.
- C₁₄H₁₅N₃ 2-Naphthylamine, *N*-{β-[(β-aminethyl)amino]ethyl}-, P 916⁹.
- C₁₄H₁₅N₃O₂ 2-Propanone, 1-(5, 6, 7, 8-tetrahydro-2-naphthoxy)-, semicarbazone, 1983⁷.
- C₁₄H₁₅N₃O₂ Δ²-2-Butenone, 4-(3-methoxy-*p*-phenethyl)-, semicarbazone, 3612¹.
(Glycine, (α-keto-γ-methylvaleryl)-, phenylhydrazine, 3892⁷.
Hydrocinnamic acid, 2 acetyl-β, 4 dimethyl-, semicarbazone, 910⁹.
- C₁₄H₁₅N₃O₄ Benzoic acid, *p*-amino, Me ester, addn. compd. with 1, 4-dimethyl-2, 5-piperazinedione, 1797².
Benzoic acid, *p*-methylanino-, addn. compd. with 1, 4-dimethyl-2, 5-piperazinedione, 1797².
- C₁₄H₁₅N₃O₄ Thiophene, tetrahydro-, 1-δ-hydroxybutyl picrate, 1639².
- C₁₄H₁₅AsBrN₂O₂ Arsanilic acid, *N*-[*N*-(α-bromoisocaproyl)glycyl]-, 71².
- C₁₄H₁₅AsN₂O₇ Arsanilic acid, *N*-[*N*-(*N*-glycylglycyl)glycyl]glycyl]-, 71¹.
- C₁₄H₁₅BrNO Isocaproamide, α-bromo-*N*-phenethyl-, 1657⁹.
- C₁₄H₁₅BrN₂S Benzothiazole, 1-heptylamino-, dibromide, -HBr, 584⁷.
- C₁₄H₁₅NO₄ Amino acid from oxidation of dihydrides - *N* - dimethylcorybulbine ethyl ether, *chloroaurate*, 2904¹.
- C₁₄H₁₅N₂ 1, 1' - Bi[cyclohexane] - 1, 1' - dinitrile, 1643².
- C₁₄H₁₅N₂O Acetic acid, β-cyclohexyl β-phenylhydrazide, 1102⁷.
Anisaldehyde, cyclohexylhydrazine, and -HCl, 1802².
- C₁₄H₁₅N₂O₂ Benzamide, *N*, *N*-diethyl-*o*(and *p*)-propionyl-, oxime, 1980⁸.
2-Pentanone, 4-methyl-, oxime, *o*-methylcarbanilate, 1628⁸.
- C₁₄H₁₅N₂O₂ Anisaldehyde, cyclohexylhydrazine peroxide, 1802².
Hydrocinnamohydroxamic acid, β-(α-formylisopropyl)-α-methyl-, oxime, 3044⁵.
- C₁₄H₁₅N₂O₂ Quinoxaline, 1, 2, 3, 4-tetrahydro-2, 3-dimethyl-, tartrate, 1653^{7, 8}.
- C₁₄H₁₅N₂S Benzothiazole, 1-heptylamino-, 584⁷.
- C₁₄H₁₅N₂ Cyclohexanenitrile, 1, 1'-azobis-, 1643².
- C₁₄H₁₅N₂O Cyclohexanone, 2-methyl-, 4-anilino-semicarbazone, 68².
- C₁₄H₁₅N₂O₇ Cyclohexylamine, 3, 5-dimethyl-, picrate, 230^{8, 9}.
- C₁₄H₁₅N₂O₂ Benzene, *m*(and *p*)-dipropionyl-, disemicarbazone, 1980^{7, 8}.
- C₁₄H₁₅O Desoxy-α-kessylene ketone, 3361⁵.
Ether, benzyl 3(and 4)-methylcyclohexyl, 737⁷.
Furan, tetrahydro-2, 2, 5-trimethyl-5-*p*-tolyl-, 910⁸.
Phenetole, *p*-cyclohexyl-, 3040⁸.
- C₁₄H₁₅O₂ Butyrophenone, 4-hydroxy-5-isopropyl-2-methyl-, 1974⁸.
Isobutyrophenone, 4-hydroxy-5-isopropyl-2-methyl-, 1974⁸.
Isovalerophenone, 4 - hydroxy - 3 - propyl-, 1974⁷.
Resorcinol, 4-(β-cyclohexylethyl)-, 3050⁸.
- C₁₄H₁₅O₂ 3-Heptanone, 1-(4-hydroxy-*m*-anisyl)-, 3615⁹.
Kessyl diketone, 3361⁵.
Spiro[naphthalene - pyran]-2', 6'(3', 5')-dione, octahydro-, 1113^{5, 8}.
- C₁₄H₁₅O₂S Cyclohexanol, methyl-, *p*-toluenesulfonate, 374^{9, 7, 8}, 375².
- C₁₄H₁₅O₄ Resorcylic acid, heptyl-, 2328¹.
- C₁₄H₁₅O₇ Glucoheptose, β-benzyl-α-, 2252².
- C₁₄H₁₅O₁₀ d-Glucose, tetraacetyl-, 900¹, 1101^{8, 7}, 2880^{3, 4}.
- C₁₄H₁₅BrN₂S Urea, α-(*p*-bromophenyl)-β-heptylthio-, 584⁵.
- C₁₄H₁₅NO 2, 4 Acetoxylyde, *N*-butyl-, 2670⁶.
Piperidine, 1-(*p*-methoxyphephenethyl)-, 2669⁴.
α-Tolamide, dipropyl-, 2669², 2758⁹.
- C₁₄H₁₅NO₂ (See also *Silvaine*.)
Butyrophenone, 4 - hydroxy - 5 - isopropyl-2-methyl-, oxime, 1974⁸.
Caproic acid, α-ethylamino-*p*-phenyl-, 2883¹.
Cyclohexanecarboxylic acid, 1-(1-cyanocyclohexyl)-, 1643².
Glycine, *N*-(γ-*p*-cumenylpropyl)-, -HCl, 1461².
—, *N*-δ-phenylbutyl-, Et ester, and -HCl, 2696².
—, *N*-(γ-*p*-tolylpropyl)-, Et ester, 1461¹.
Isobutyrophenone, 4-hydroxy-5-isopropyl-2-methyl-, oxime, 1974⁸.
Pyrrolidine, 2, 5-bis(hydroxymethyl)-1-*p*-methylbenzyl-, and -HCl, 412⁹.
- C₁₄H₁₅NO₄ 5, 5-*m*-Dioxanedicarbinol, 2-(*p*-dimethylaminophenyl)-, 895⁸.
- C₁₄H₁₅NO₈ Eranthic acid, methylphenylsulfonamido-, 258⁴.
- C₁₄H₁₅NO₇ Hydroxymethylphenylpropylammonium acid tartrate, 65⁷.
- C₁₄H₁₅N₂O 2-Hexanone, 5-*p*-tolyl-, semicarbazone, 910⁹.
- C₁₄H₁₅N₂O₂ Butyrophenone, 4-hydroxy-3-propyl-, semicarbazone, 1974⁷.
2-Pentanone, 4-benzoyloxy-4-methyl-, semicarbazone, 892⁸.
- C₁₄H₁₅ Naphthalene, octahydroisopropylidene-methyl-, 2880¹.
- C₁₄H₁₅AsN₂O₂ Arsanilic acid, *N*-(*N*-leucylglycyl)-, and *Ca salt*, 71².
- C₁₄H₁₅Cl₂O Desoxy-α-kessyl ketone, dichloride, 3361⁵.
- C₁₄H₁₅IN *as*-Homotetrahydroisoquinoline, 8-isopropyl-, methiodide, 1461³.
- C₁₄H₁₅INO₂ (Carboxymethyl)dimethylphenethylammonium iodide, Et ester, 1460⁴.
- C₁₄H₁₅N₂ Euanthaldehyde, methylphenylhydrazine, 69¹.
Putrescine, *N*-(1, 2, 3, 4-tetrahydro-2-naphthyl)-, and salts, 566².

- C₁₄H₂₂N₂O Isocaproamide, α -amino-*N*-phenethyl-, and -HCl, 1657^a, 1658^a.
- C₁₄H₂₂N₂O₂ (See also *Tuocaine*.)
2(1)-Pyrimidone, 5,5-diallyl-4,6-epoxy-4,6-diethyltetrahydro-(?), 3351^a.
- C₁₄H₂₂N₂O₄ 1,2-Pyridazinedicarboxylic acid, 3,6-dihydro-4- Δ^1 -isohexenyl-, di-Me ester, 1123^a.
- C₁₄H₂₂N₂S Urea, α -heptyl- β -phenylthio-, 584^a.
- C₁₄H₂₂N₄ Cyclohexanenitrile, 1,1'-hydrazinobis-, 1643^a.
- C₁₄H₂₂N₂O Butyrene, 4-anilinosemicarbazone, 68^a.
 β -vanthaldehyde, 4-anilinosemicarbazone, 68^a.
3-Pentanone, 2,4-dimethyl-, 4-anilinosemicarbazone, 68^a.
- C₁₄H₂₂N₄O₇ Tetraethylammonium picrate, 1397^a.
- C₁₄H₂₂N₂O₃ 2-Propanol, 1-diethylamino-2-methyl-, picrate, 2248^a.
Tetraethylammonium styphnate, 1397^a.
- C₁₄H₂₂N₂O₁₀ Ethanol, 2-[β -(β -dimethylaminoethoxy)ethoxy]-, picrate, 3880^a.
- C₁₄H₂₂N₂O₇ Guanidine, α , α -diethyl- β , γ , γ -trimethyl-, picrate, 2879^a.
Hexamethylguanidinium trinitro-*m*-cresolate, 2878^a.
- C₁₄H₂₂O Anisole, 2-isopropyl-5-methyl-4-propyl-, 1974^a.
2,4-Xylenol, 6-(β -methylamyl)-, 72^a.
- C₁₄H₂₂O₂ Isokessyl ketone, 2263^a, 3361^a.
Kessyl ketone, 3361^a.
1(2)-Naphthalenone, octahydro-7-isopropylidene-4a-methyl-, 2888^a.
 α -Tolualdehyde, di-Pr acetal, 3608^a.
- C₁₄H₂₂O₄ Δ^1 -Cyclohexenemalonic acid, α -methyl-, di-Et ester, 228^a.
1,1(2)[and 2,2(1)]-Naphthalenediacetic acid, octahydro-, 1113^a.
2-Naphthol, decalhydro-, acid succinate, 1112^a.
Succinic acid, monobornyl and monoisobornyl esters, 2682^a.
- C₁₄H₂₂O₂ Kessylonic acid, 3361^a.
- C₁₄H₂₂O₃ Galactose, diacetone-, Me xanthate, 1634^a.
d-Glucose, diacetone-, Me dithiolcarbonate, 1634^a; Me xanthate, 1634^a.
Mannose, diacetone-, Me xanthate, 1634^a.
- C₁₄H₂₂N Amylamine, *N*-(γ -phenylpropyl)-, -HCl, 2882^a.
Phenethylamine, *N*, *N*-dipropyl-, 2609^a.
- C₁₄H₂₂NO Butylamine, *N*, *N*-diethyl- δ -phenoxy-, 3355^a.
- C₁₄H₂₂N₂O₂ α -Toluenesulfonamide, *N*-heptyl-, 99^a.
- C₁₄H₂₂N₂O Cyclohexanone, 2- Δ^1 -cyclohexenyl-2-methyl-, semicarbazone, 1103^a.
- C₁₄H₂₂N₂O₇ (β - Dimethylaminoethyl)ethyldimethylammonium picrate, 2660^a.
- C₁₄H₂₂INO [α -(Hydroxymethyl)- δ -phenylbutyl]-trimethylammonium iodide, 59^a.
- C₁₄H₂₂N₂ 2,2'-Biimidazole, 1,1'-diethyl-, diethiodide, 3364^a.
- C₁₄H₂₂N₂ 2,2'-Biimidazole, 1,1'-diethyl-, diethiodide, periodide, 3364^a.
- C₁₄H₂₂N₂O₄ Compd., m. 222^a, from 3,6-dimethyl-2,5-piperazinedione and leucylglycine, 248^a.
- C₁₄H₂₂O Alc., b. 119-22^a, from elemol, 578^a.
Desoxy- α -kessylanone, 3361^a.
1-Naphthol, decalhydro-7-isopropylidene-4a-methyl-, 2889^a.
- C₁₄H₂₂O₂ Butyric acid, geranyl ester, 1407^a; linalool ester, 3707^a.
- Cyclohexanone, 2-cyclohexylidene-, EtOH addn. compd., 231^a.
Isokessyl alcohol, 2263^a.
Kessyl alcohol, 2263^a, 3361^a.
1(2)-Naphthalenone, octahydro-7-hydroxy-7-isopropyl-4a-methyl-, 2888^a.
- C₁₄H₂₂O₄ 1,2-Cyclohexanediactic acid, di-Et ester, 1112^a.
Malonic acid, Δ^{10} -hendecenyl-, 895^a.
Succinic acid, monomethyl ester, 2889^a.
- C₁₄H₂₂BrO₄ Adipic acid, α -bromo- β , β , γ , γ -tetramethyl-, di-Et ester, 1968^a.
- C₁₄H₂₂NO γ , δ -Decadienamide, *N*-isobutyl-(?), 3348^a.
- C₁₄H₂₂N₂O Acetone, 4-bornylsemicarbazone, 3613^a.
Cyclohexanone, 2-(cyclohexylmethyl)-, semicarbazone, 409^a.
- C₁₄H₂₂N₂O₂ 2,5-Piperazinedione, 3-isobutyl-4-leucyl-, 248^a.
- C₁₄H₂₂N₂O₂ Asparagine, *N*-acetyl-*N* β -(carbethoxymethyl)-, Et glycinate salt, 61^a.
- C₁₄H₂₂BrN Spiro[piperidine-1,1'(2')quinoline], 1-bromo-3',4',4'a,5',6',7',8',8'a - octahydro-, 96^a.
- C₁₄H₂₂N₂O₂ 2,5-Piperazinedione, 3-hexyl-6-isobutyl-, 1965^a.
2(1)-Pyrimidone, 4,6-epoxy-5,5-diethyltetrahydro-4,6-dipropyl-(?), 3351^a.
- C₁₄H₂₂N₂O₃ Proline, 1-(*N*, *N*-dimethylleucyl)-, Me ester, 390^a.
- C₁₄H₂₂O Desoxykessylanol, 3361^a.
- C₁₄H₂₂O₂ Acid from sei-whale oil, 1719^a.
Camphor, di-Et acetal, 1808^a.
 α -Dodecenic acid, ethyl ester, 2873^a.
 λ -Tridecenic acid, Me ester, 895^a, 2873^a.
 λ -Tridecenic acid, α -methyl-, 2873^a.
- C₁₄H₂₂O₂ Caproic acid, α -acetyl- α -butyl-, Et ester, 3317^a.
Tridecoic acid, λ -keto-, methyl ester, 2873^a.
—, λ -keto- α -methyl-, 2873^a.
- C₁₄H₂₂O₂ Adipic acid, β , β , γ , γ -tetramethyl-, di-Et ester, 58^a.
Brassylic acid, α (and β)-methyl-, 3349^a.
1,10-Decanedicarboxylic acid, di-Me ester, 1630^a.
1,10-Decanedicarboxylic acid, methyl-, Me ester, 3349^a.
1,12-Dodecanedicarboxylic acid, 390^a.
1,9-Nonanedicarboxylic acid, 2-methyl-, di-Me ester, 3350^a.
- C₁₄H₂₂Br 1-Tridecene, 13-bromo-12-methyl-, 2873^a.
- C₁₄H₂₂BrO₂ Tridecoic acid, μ -bromo-, Me ester, 3349^a.
- C₁₄H₂₂NO Caprylic acid, cyclohexylamino-, 2876^a.
 λ -Tridecenamide, α -methyl-, 2873^a.
- C₁₄H₂₂NO₂ Caproic acid, α -acetyl- α -butyl-, Et ester, oxime, 3347^a.
- C₁₄H₂₂NO₂ Aspartic acid, diisoamyl ester, 1798^a.
Malonic acid, (γ -diethylaminopropyl)-, di-Et ester, 3355^a.
- C₁₄H₂₂N₂O₂ 2-Hendecanone, 11-hydroxy-, acetate, semicarbazone, 894^a.
Lauric acid, α -formyl-(?), semicarbazone, 3349^a.
Pyruvic acid, decyl ester, semicarbazone, 2658^a.
Undecylic acid, α -formyl- α -methyl-(?), semicarbazone, 3349^a.
- C₁₄H₂₂N₂O₄ Leucine, *N*-(*N*-leucylglycyl)-, 567^a.

- C₁₁H₂₁Br₂** Tridecane, dibromomethyl-, 2873⁹, 3349⁷.
C₁₁H₁₁N₂ Quinoline, 1-(4-aminoamyl)decahydro-, 964.
C₁₁H₁₆N₂O₄ Adipic acid, α , δ -bis(diethylamino)-, 604.
 Adipic acid, α , δ -bis(dimethylamino)-, di-Et ester, 597.
C₁₁H₂₀O Alc., b. 12 120°, from elemol, 578¹.
C₁₁H₂₀O 1-Tridecenol, 2-methyl-, 2873⁹.
C₁₁H₁₈O₂ (See also *Myristic acid*.)
 Butyric acid, decyl ester, 2658⁹.
 Capric acid, Bu ester, P 593².
C₁₁H₁₈O₂S Myristic acid, α -mercapto-, 3045⁹.
C₁₁H₂₀O₄ Enanthaldehyde, α -hydroxy-, dimer, 3608⁹.
C₁₁H₂₁BrO 1-Tetradecanol, 14-bromo-, 3350⁹.
C₁₁H₂₁NO Myristamide, 2874⁴.
C₁₁H₂₁N₂O 2-Tridecanol, semicarbazone, 2659¹.
C₁₁H₂₁N₂O₂ Acetamide, α , α' -iminobis[*N*-isomethyl-, 1657⁹.
C₁₁H₂₀Cl₂N₂O₂Pt γ -Cyano- γ -(hydroxypropyl)trimethylammonium chloroplatinate, 1632¹.
C₁₁H₂₀N₂O Isocaproamide, *N*-ethyl- α -isohexylamino-, and -HCl, 1657⁹.
 Propionamide, *N*-isomethyl- α -isohexyl-, and -HCl, 1657⁹.
C₁₁H₂₀O Ether, butyl decyl, 2658⁷.
 1-Tetradecanol, 2874⁴.
C₁₁H₂₀O₂ Tridecanediol, methyl-, 2873⁹, 3349⁷.
C₁₁H₂₀O₂Pb Triethyllead caprylate, 1445².
C₁₁H₂₀O₂S Rhamnose, di-Bu mercaptal, 64⁴.
C₁₁H₂₀O₂S Galactose, di-Bu mercaptal, 64⁴.
 d-Glucose, di-Bu mercaptal, 64⁴.
 Mannose, di-Bu mercaptal, 64⁴.
C₁₁H₂₀CuN₂O₂S₂ + 4H₂O Triethylsulfonium cupribiuret, 866⁹.
C₁₁FeN₂O₄ Iron ferro-nitrito-pentacyanide, 1769⁹.
C₁₁H₇Br₂N₂O 3-Phentriazinol, 6,11-dibromo-, 2895⁹.
C₁₁H₇ClO₂ Anthraquinonecarboxyl chloride, 374.
C₁₁H₇NO Quinoline, C₂O₂ addn. compd., 735⁹.
C₁₁H₂Br₂Cl Anthracene, 9-bromo-10-(bromomethylene)-1,5-dichloro-9,10-dihydro-, 1261².
C₁₁H₂Br₂N Phenanthrazine, 3-aminodibromo-, 3201²; and salts, 2895⁴.
C₁₁H₂ClNO₂ 2-Anthraquinonealdehyde, 1-amino-4-chloro-, P 2478¹.
C₁₁H₂Cl₂O Anthraquinone, 2,4-dichloro-1-methyl-, 3053⁴.
C₁₁H₂N₂O₂ 2-Phenanthrothiazine, 2-thio-, 3199⁹.
P₁₁H₂N₂O₄ Phenanthrazine, 3-amino-6,11 (and 8,9)-dinitro-, 3201².
C₁₁H₂N₂O₄ Isoindazole, 1,1'-carbonylbis[6-nitro-, 1120⁹.
C₁₁H₂O₄ Rhine, 274⁹.
C₁₁H₂BrClNO₂S 5-Benzothiazolol, 4 (and 6)-bromo-6 (and 4)-chloro-1-phenyl-, acetate, 2692².
C₁₁H₂BrCl Anthracene, 9-(bromomethyl)-1,5-dichloro-, 1261¹.
C₁₁H₂BrN Phenanthrazine, 3-amino-6-bromo-, 3201².
C₁₁H₂BrO 1-Indone, 2-bromo-3-phenyl-, 3614².
C₁₁H₂Br₂NO Vanillonitrile, 5,6-dibromo-, benzoate, 2258⁹.
C₁₁H₂BrNO₂S 4-Benzisothiazolol, 3,5-dibromo-2-phenyl-, acetate, 2693².
C₁₁H₂Br₂N₂O₂ Phenanthrenequinone, 2,7-dibromo-, monosemicarbazone, 2895⁴.
C₁₁H₂Br₂Cl Anthracene, 9,10-dibromo-9-(bromomethyl)-1,5-dichloro-9,10-dihydro-, 1261².
C₁₁H₂ClN₂O₂ Quinoline, chloro, picrate, 94⁴.
C₁₁H₂Cl₂NO₂ Anthracene, 1,5-dichloro-9-methyl-10-nitro-, 1260⁷.
C₁₁H₂Cl₂NO₂S 4-Benzisothiazolol, 3,5-dichloro-2-phenyl-, acetate, 2693².
C₁₁H₂Cl₂ Anthracene, 1,5-dichloro-9-(chloromethyl)-, 1261¹.
C₁₁H₂NO₂ 4-Fluoreneboxylic acid, 9-keto-, nitro-, Me ester, 1987⁹.
C₁₁H₂N₂O 8(3)-Indeno[1,2-*b*]triazolone, 3-phenyl-, 742⁴.
C₁₁H₂N₂O 4-Quinazolinecarboxylic acid, 2-(*o*-nitrophenyl)-, 3905⁷.
C₁₁H₂N₂O Oxazole, 2,5-bis(nitrophenyl)-, 1984⁹.
C₁₁H₂N₂O₂ Phenanthrazine, 3-amino-6 (and 8)-nitro-, 3201².
C₁₁H₂N₂O₂S 3,5(2,4)-*as*-Triazinedione, 2-(*o*-nitrophenyl)-6-(*o*-nitrophenylazo)-, 1654⁴.
C₁₁H₂BrNO₂S 4-Benzisothiazolol, 3-bromo-2-phenyl-, acetate, 2693².
C₁₁H₂Br₂O 1-Indanone, 2,3-dibromo-3-phenyl-, 3614².
C₁₁H₂ClNO₂S 4-Benzisothiazolol, 3-chloro-2-phenyl-, acetate, 2693².
C₁₁H₂Cl₂ Anthracene, 1,5-dichloro-9-methyl-, 1260⁷.
C₁₁H₂Cl₂O 9-Anthracenecarbinol, 1,5-dichloro-, 1260⁹.
 9-Anthrol, 1,5-dichloro-9, 10-dihydro-10-methylene(-?), 1261².
 —, 1,5-dichloro-10-methyl(-?), 1261².
 Anthrone, 1,5-dichloro-10-methyl(-?), 1261².
C₁₁H₂Cl₂O₂ Benzoic acid, *o* (1,6-dichloro-methyl)-, 3053².
C₁₁H₂N₂O 7(5)-Isoindoloquinazolinone, 3201².
C₁₁H₂N₂O₂ Oxazole, 5-(*m*-nitrophenyl)-2-phenyl-, 1984⁹.
 4-Quinazolinecarboxylic acid, 2-(*p*-hydroxyphenyl)-, 3905⁷.
 —, 2-salicyl-, 3903⁷.
C₁₁H₂N₂O₂ 2(1)-Anthranilone, 1,1'-methylenebis-, 1641¹.
 9-Fluorenone, 5-acetamido-2-nitro-, 1987⁷.
C₁₁H₂N₂O₂S 4-Benzisothiazolol, 3-nitro-2-phenyl-, acetate, 2693².
C₁₁H₂N₂O₂ Isatic acid, *N*-*o*-nitrobenzoyl-, 3905⁷.
C₁₁H₂N₂O₂S₂ 2,2'-Stilbenedisulfonic acid, α -hydroxy-4,4'-dinitro-, anhydride, Me ester, 908⁹.
C₁₁H₂N Triazoloquinoline, phenyl-, 2690¹; and salts, 2129⁷.
C₁₁H₂N₂O Acenaphthotriazine, 9-acetamido-, 3201².
C₁₁H₂N₂O₄ Picolinic acid, 3-[4-carboxy-1-phenyl-3-(1,2,5-triazolyl)]-, and Ba salt, 2129⁹.
 Pyrazole, 1,3-bis(*p*-nitrophenyl)-, 1450⁷.
C₁₁H₂N₂O₂ Isoquinoline, *N*-oxide, picrate, 94⁷.
 Quinoline, *N*-oxide, picrate, 94⁷.
C₁₁H₂N₂O₂ Carbanilide, *m,m'* (and *p,p'*)-dicyanothio-, 1637⁹.
C₁₁H₂O₂ Flavone, 7-hydroxy-, 93⁹.
 Umbelliferone, 3-phenyl-, 3193¹.
C₁₁H₂O₄ Anthraquinone, 2,4-dihydroxy-1-methyl-, 3053⁴.
 Chrysin, 93⁹.
 Chrysophanic acid, 274².
 Coumarin, 5,7 (and 7,8)-dihydroxy-3-phenyl-, 3193⁴.

- Rubiadin, 3053².
Shikizarin, 2905¹.
C₁₁H₁₀O₆ Coumarin, 5,7-dihydroxy-3-(*p*-hydroxyphenyl)-, 3193².
Emodin, 274¹.
Genistein, 246¹.
Morindone, 3194¹.
Prunetol, 246¹, 3193².
C₁₁H₁₀O₆ Fisetin, 92².
Umbelliferone, 4-(3,4,5-trihydroxyphenyl)-, 1981².
C₁₁H₁₀O₆ Coumarin, 5,7-dihydroxy-4-(3,4,5-trihydroxyphenyl)-, 1981².
Quercetin, 92², 1267², 2147¹.
C₁₁H₁₁BrClO₂ 9-Anthracenecarbinol, 9-bromo-1,5-dichloro-9,10-dihydro-10-hydroxy-(?), 1261².
C₁₁H₁₁BrO Chalcone, α -bromo-, 3051⁴.
1-Indanone, 2-bromo-3-phenyl-, 3614⁵.
C₁₁H₁₁BrO₂ Cinnamic acid, *p*-bromophenyl ester, 2893⁴.
C₁₁H₁₁BrO₂ Coumarilic acid, 2-bromo 1,2-dihydro-1-phenyl-, 911².
Phthalide, 2-(5-bromo-*o*-anisyl)-, 3357¹.
C₁₁H₁₁Br₂N₂O₂ Acetyl deriv., m. 220°, of acid from 1-(2,4-dibromophenyl)-7-triazirindiazeneone, 1638².
C₁₁H₁₁Br₂O Creosol, 3,5,6-tribromo-, benzoate, 2124¹.
9-Xanthencarboxylic acid, 9-bromo-, *p*-bromide, Me ester, 3055².
C₁₁H₁₁ClO₂ Cinnamic acid, *p*-chlorophenyl ester, 2126¹, 2893⁴.
Cinnamic acid, *p*-chloro-, Ph ester, 2126¹.
1,3-Propanedione, 1-(*m*-chlorophenyl)-3-phenyl-, 81².
C₁₁H₁₁ClO₂ 5,7-Dihydroxyflavylium chloride, 3620².
C₁₁H₁₁ClO₂ 5,7,4'-Trihydroxyflavylium chloride, 3620².
Vanilloyl chloride, benzoate, 93⁴.
C₁₁H₁₁ClO₂ 3,7,2',4'-Tetrahydroxyflavylium chloride, 3620².
C₁₁H₁₁ClO₂ 5,7-Dihydroxyflavylium perchlorate, 3620².
C₁₁H₁₁ClO₂ 5,7,4'-Trihydroxyflavylium perchlorate, 3620².
C₁₁H₁₁I₂NO₂ Alanine, β -[4-(4-hydroxy-3,5-diiodophenoxy)-3,5-diiodophenyl]-, 2469¹.
C₁₁H₁₁N Cinnamitrile, α -phenyl-, 3898².
Isoquinoline, 1-phenyl-, 1655⁴.
C₁₁H₁₁NO₂ 2-Indolecarboxylic acid, 3-phenyl-, 1269².
2,4-Quinolinediol, 3-phenyl-, 1980².
C₁₁H₁₁NO₂S 4-Benzisothiazolol, 2-phenyl-, acetate, 2693².
5-Benzothiazolol, 1-phenyl-, acetate, 2692².
C₁₁H₁₁NO₂S 6-Benzoxazolol, 1-methyl-, benzoate, 3363².
9-Phenanthrenecarboxylic acid, 8-amino-9,10-dihydro-10-hydroxy-, cyclic lactam, 2260¹.
C₁₁H₁₁NO₂S 2-Styryl-1,3-benzodithiylum nitrate, 1985².
C₁₁H₁₁NO₂ Cinnamic acid, nitrophenyl ester, 2893⁴.
Cinnamic acid, *p*-nitro-, phenyl ester, 2893⁴.
C₁₁H₁₁NO₂ Isatic acid, *N*-*p*-hydroxybenzoyl-, 3905².
Isatic acid, *N*-salicyl-, 3905².
C₁₁H₁₁N₂O₂ Pyrazole, 1-(*p*-nitrophenyl)-3-(and 5)-phenyl-, 1450^{2,7}.
4,5-Pyrazolodione, 1,3-diphenyl-, 4-oxime, 1099².
C₁₁H₁₁N₂O₂ 1,4-Imidazopyridin-2(3)-one, 3-(2,3-dihydro-3-hydroxy-2-keto-3-indyl)-, and -HCl, 1265⁴.
Indazole, 6-nitro-2-*o*-(and *p*)-toluyl-, 1120².
Isoindazole, 6-nitro-1-toluyl-, 1120².
5-Pyrazolone, 1-(*p*-nitrophenyl)-3-phenyl-, 1450².
C₁₁H₁₁N₂O₂S Benzisothiazole, 4-acetamido-3-nitro-2-phenyl-, 2693⁴.
C₁₁H₁₁N₂O₂S 5-Quinolinesulfonic acid, 8-hydroxy-7-phenylazo-, 1461⁴.
C₁₁H₁₁N₂O₂ 3,5(2,4)-*as*-Triazinedione, 2-phenyl-6-phenylazo-, 1654⁴.
C₁₁H₁₁N₂O₂S Benzisothiazole, 4-acetamido-3-(*p*-nitrophenylazo)-, 2693¹.
C₁₁H₁₂ Anthracene, methyl-, 1110², P 2478².
C₁₁H₁₂BrN₂O Benzimidazole, 5-acetamido-4-bromo-2-phenyl-, 2691².
C₁₁H₁₂Br₂O Creosol, 3,5-dibromo-, benzoate, 2124².
C₁₁H₁₂ClN₂O Benzimidazole, 5-acetamido-4-chloro-1-phenyl-, 2691².
Benzimidazole, 4-(and 6)-chloro-5-formamido-1-*p*-tolyl-, 2691².
C₁₁H₁₂Cl₂O 9-Anthrol, 1,5-dichloro-9,10-dihydro-9-methyl-, 1260².
Propiophenone, α,β -dichloro- β -phenyl-, 3051².
C₁₁H₁₂Cl₂NO₂ 1,3,2-Oxazin-2-one, tetrahydro-4-hydroxy-4-(1-naphthyl)-6-(trichloromethyl)-, 3611².
C₁₁H₁₂N₂ Pyrazole, 1,4-diphenyl-, 2259².
C₁₁H₁₂N₂O Acrylophenone, β -phenylazo-, 1450⁴.
Isoindazole, 1-benzoyl-3-methyl-, 1119⁴.
1,3,4-Oxadiazole, 2-phenyl-5-*p*-tolyl-, and AgNO₃ compd., 573².
C₁₁H₁₂N₂O₂S Acetanilide, *p*-(*p*-isothiocyanophenyl)-, 80².
Benzisothiazole, 4-acetamido-2-phenyl-, 2693².
C₁₁H₁₂N₂O₂ 5(10)-Acridone, 3-acetamido-, 232⁴.
5-Benzimidazolol, 1-phenyl-, acetate, 2691².
Glycinonitrile, *N*-(*o*-hydroxyphenyl)-, benzoate, 1794⁴.
Phthalic anhydride, methylphenylhydrazone, 1329¹.
C₁₁H₁₂N₂O₂S 4-Quinazolinecarboxylic acid, 1,2,3,4-tetrahydro-4-hydroxy-3-phenyl-2-thioke to-, 587².
C₁₁H₁₂N₂O₂ Benzamide, *o*'-acetyl-(and *m*)-nitro-, 3905².
4-Quinazolinecarboxylic acid, 1,2,3,4-tetrahydro-4-hydroxy-2-keto-3-phenyl-, and -HCl, 587^{2,3}.
C₁₁H₁₂N₂O₂S Benzoic acid, *o*,*o*'-thioureidobis-, 1637².
C₁₁H₁₂N₂O₂S Piperonal, *N*- and *O*-*p*-nitrobenzyl-oxime, 2257^{2,4,6}.
C₁₁H₁₂N₂O₂S Ethanol, 2-(*m*-nitrophenylmercapto)-, *p*-nitrobenzoate, 3191².
C₁₁H₁₂N₂O₂ Hydracrylic acid, α,β -bis(*o*-nitrophenyl)-, 2259².
C₁₁H₁₂N₂S Benzothiazole, 4-benzalamino-1-mercapto-5-methyl-, 2689².
C₁₁H₁₂N₂ Pyridine, 2,2',2''-nitritoltris-, and -HCl compd., 3620¹.
C₁₁H₁₂N₂O₂ Indole, 2-methyl-3-(*p*-nitrophenylazo)-, 1263².
Isoindazole, 1-acetyl-6-(*p*-hydroxyphenylazo)-, 1120².
1,2,4-Oxadiazolol, benzoyl-, phenylhydrazone, 2404^{2,3}.
C₁₁H₁₂N₂O₂ Indole, 7-methyl-, picrate, 912².
C₁₁H₁₂NO Chalcone, 397², 3888².

- C₁₅H₁₃O₂ Cinnamic acid, Ph ester, 1266¹.
1,3-Propanedione, 1,3-diphenyl-, 576¹.
C₁₅H₁₃O₂ Chalcone, 2',4'-dihydroxy-, 3194¹.
Coumarilic acid, 1,2-dihydro-1-phenyl-, 911⁸.
Flavanone, 7-hydroxy-, 3193⁹.
Phthalide, 2-*p*-anisyl-, 3357¹.
9-Xanthencarboxylic acid, Me ester, 3055².
—, methyl-, 3904⁸.
C₁₅H₁₃O₄ Chalcone, 2',3',4'-trihydroxy-, 3194¹.
Mandelic acid, benzoate, 2938⁴.
Pyrocatechol, acetate, benzoate, 1639⁷.
C₁₅H₁₃O₄ Acetophenone, α,2,4-trihydroxy-, benzoate, 93².
Chalcone, tetrahydroxy-, 3194¹.
C₁₅H₁₃O₆ 1,3,6-Naphthalenetetracarboxylic acid, 4,7-dimethyl-, and Ag salt, 1647^{2,4}.
Phloracetophenone, α-hydroxy-, benzoate, 93².
C₁₅H₁₃S₂ 1,3-Benzodithiole, 2-styryl-, 1985².
C₁₅H₁₃AsN₂O₆ 6-Quinoxalinecarsonic acid, 1,4-dihydro-2(and 3)-hydroxy-, benzoate, 2255².
C₁₅H₁₃AsO₄ Me ester, m. 117°, of compd. from arsonoacetic acid and pyrocatechol, 905⁴.
C₁₅H₁₃Br Ethylene, 2-bromo-1-phenyl-1-*p*-tolyl-, 909⁴.
C₁₅H₁₃BrN₂O₂ 2,6-Benzoxylide, 3'(and 4')-bromo-3-nitro-, 2670⁴.
C₁₅H₁₃BrO Anisole, *p*-[α-(bromomethylene)benzyl]-, 909⁴.
C₁₅H₁₃BrO₂ Acetic acid, bromodiphenyl-, Me ester, 238⁸.
C₁₅H₁₃Br₂NO₂ Creosol, 5,6-dibromo-α-*p*-tolylimino-, 2258⁴.
C₁₅H₁₃Br₂N₂O₂ Anthranilic acid, *N*-acetyl-, 2,4-dibromophenylhydrazide, 1638⁸.
C₁₅H₁₃ClO 1,4-Naphthoquinone, 2-(β-chloropropyl)-3-hydroxy-, acetate, 241².
C₁₅H₁₃ClO₄ 2,3-Dimethyl-β-naphthopyrylium perchlorate(?), 408³.
3-Ethyl-β-naphthopyrylium perchlorate(?), 408³.
C₁₅H₁₃NO Acridine, 4-ethoxy-, 1461⁷.
Benzamide, *N*-styryl-, 1655⁴.
Chalcone, α-amino-, and salts, 3905⁴.
Hydrocarbostyryl, 1-phenyl-, 1979⁸.
Indole, 3-methoxy-2-phenyl-, 913².
α-Tolualdehyde, α-(anilinomethylene)-, 2259⁷.
C₁₅H₁₃NO₂ 5(10)-Acridone, 4-ethoxy-, 1461⁴.
C₁₅H₁₃NO₂ Benzanilide, *o*'-acetyl-*p*-hydroxy-, 3905⁷.
2-Furo[3,2-*f*]quinolinecarboxylic acid, 7-methyl-, Et ester, 382⁸.
Mandelamide, benzotae, 1984⁸.
Salicylanilide, *o*'-acetyl-, 3905⁸.
m-Toluic acid, 2-benzamido-, 912⁶.
C₁₅H₁₃NO₄ Acetanilide, 2,4-dihydroxy-, 4-benzoate, 3363⁹.
C₁₅H₁₃N₃ Pyrazole, 1-(*p*-aminophenyl)-5-phenyl-, 1450⁶.
C₁₅H₁₃N₂O Indazole, 6-anisal-, 1120⁴.
1,2,4-Triazol-5-ol, 1-phenyl-3-*p*-tolyl-, 74^{2,4}.
C₁₅H₁₃N₂O₃ α-Tolunitrile, *m*-nitro-α-*o*(*m* and *p*)-toluino-, 2125⁹.
C₁₅H₁₃N₂O₃S Benzothiazole, 5-dimethylamino-1-[*o*(*m* and *p*)-nitrophenyl]-, 1985⁸.
1,3,4-Oxadiazole, 3-acetyl-2,3-dihydro-5-methylmercapto-2-naphthylimino-, 3200².
C₁₅H₁₃N₂O₃ Acrylophenone, β-[(*p*-nitrophenyl)hydrazinyl]-, 1450⁴.
Mesoxalanilide, oxime, 355².
1,2,4-Oxadiazol-3-ol, 5-benzoyl-, PhNH₂ salt, 240⁴.
C₁₅H₁₃N₂O Acetophenone, 3,4-methylenedioxy-, *p*-nitrophenylhydrazone, 3336⁸.
C₁₅H₁₃N₂O₃ 3-Isindazolecarboxylic acid, 1²(*o*-nitrobenzoyl)-, 2900².
Protocatechualdehyde, acetate, *p*-nitrophenylhydrazone, 1107⁹.
C₁₅H₁₃N₂O₃ Anisaldehyde, 3-nitro-, *N*- and *O*-*p*-nitrobenzyloxime, 2257^{4,8}.
Benzaldehyde, 2-methoxy-5-nitro-, *N*- and *O*-*p*-nitrobenzyloxime, 2257^{2,8}.
Benzoic acid, *p* 2,4-dinitroanilino-, Et ester, 378⁸.
C₁₅H₁₃N₂O₃ Acetanilide, 4-formyl-2-nitro-, *p*-nitrophenylhydrazone, 1254⁸.
C₁₅H₁₃N₂O₇ Indole, 3-(aminomethyl)-, picrate, 87¹.
C₁₅H₁₃ Ethylene, 1-phenyl 1-*p*-tolyl-, 909⁸.
C₁₅H₁₃AsBrO₃ 6-(Carboxymethyl)-6-methylphen-oxarsonium bromide, 1653⁹.
C₁₅H₁₃AsNO₂ Phenarsazine, 6-acetyl-1,6-dihydro-1-methyl-, 1654¹.
C₁₅H₁₃AsNO₂ Arsanilic acid, *N*-(acetylsalicyl)-, 3612⁸.
C₁₅H₁₃BrNO₂ Creosol, 6-bromo-α-*p*-tolylimino-, 2258⁴.
C₁₅H₁₃CINO Propane, 2-chloro-2-nitroso-1,3-diphenyl-, 2872⁹.
Propionamide, *N*, *N*-diphenyl-, 1979⁷.
Propiophenone, β-amino-α-chloro-β-phenyl-, -HCl, 3888⁹.
C₁₅H₁₃CINO₂ Propane, 2-chloro-2-nitro-1,3-diphenyl-, 2873¹.
C₁₅H₁₃N₂O Acrylophenone, β-(phenylhydrazino)-, 1450^{3,4}.
Hydroxylamine, β-[β-(phenyliminomethyl)-styryl]-, 2259⁸.
α-Tolunitrile, α-(hydroxyanilino)-α-methyl-, 1449⁹.
C₁₅H₁₃N₂OS Benzothiazole, 5-dimethylamino-1-[*m*(and *p*)-hydroxyphenyl]-, 1985⁸.
Benzothiazole, 5 dimethylamino-1-salicyl-, 1985⁸.
2(1)-Quinazolone, 3,4-dihydro-4-methoxy-3-phenyl 2 thio-, 587⁷.
C₁₅H₁₃N₂O₂ Benzanilide, *o*' acetyl-, oxime, 1119⁴.
Glyoxime, diphenyl-, Me deriv., 1098⁴.
Hydrazine, α-benzoyl-β-*p*-tolyl-, 573¹.
2(1) Quinazolone, 3,4-dihydro-4-methoxy-3-phenyl-, 587⁸.
C₁₅H₁₃N₂O₂ Acetanilide, *N*-methyl-2-nitro-4-phenyl-, 2680⁹.
Benzoic acid, 3-acetyl-4-hydroxy-, phenylhydrazone, 1980⁸.
Benzoxylide, 3-nitro-, 2670^{4,8}.
p-Piperonylhydroxamatoilide, 1107¹.
Propane, 2 nitro-2-nitroso-1,3-diphenyl-, 1626².
o-Toluamide, *N*-(*o*-nitrobenzyl)-, 1119⁷.
C₁₅H₁₃N₂O₄ Acetophenone, 2,4-dihydroxy-, oxime, carbanilate, 1628⁸.
Anisaldehyde, *N*- and *O*-*p*-nitrobenzyloxime, 2257^{2,8}.
Benzaldehyde, *o*-methoxy-, *N*- and *O*-*p*-nitrobenzyloxime, 2257^{2,7}.
o-Benzophenetide, *m*-nitro-, 1451⁴.
Propane, 2,2-dinitro-1,3-diphenyl-, 1626².
C₁₅H₁₃N₂O₃S Benzisulfonazole, 1,2-dihydro-1-methyl-2-*o*-tolylsulfonylimino-, 2888⁸.
C₁₅H₁₃N₂O₃ Toluene, 3-methoxy-2(and 6)-nitro-4-(*p*-nitrobenzyloxy)-, 3007⁷.
C₁₅H₁₃N₂O₃S *m*-Toluenesulfonanilide, 6-hydroxy-5-nitro-, acetate, 3897⁴.
C₁₅H₁₃N₂S Urea, dibenzylthio-, 671¹.

- C₁₅H₁₄N₄O₂ Benzil, 4-aminosemicarbazone, 1249¹.
- C₁₅H₁₄N₄O₂ Acetanilide, *p*-formyl-, *p*-nitrophenylhydrazone, 1254⁴.
- C₁₅H₁₄N₄O₂ Benzaldehyde, nitro-, β -ethyl- β -(*p*-nitrophenyl)hydrazone, 1251⁴.
- C₁₅H₁₄N₄O₂ Piperidine, 1-(1,6,8-trinitro-2-naphthyl)-, 404⁷.
- C₁₅H₁₄N₄O₂ Acetamide, *N*-propyl-*N*-(1,6,8-trinitro-2-naphthyl)-, 404⁸.
- C₁₅H₁₄N₄O₂ Phenol, *p*-methylamino-, acetate, picrate, 2886².
- C₁₅H₁₄N₄S 1,3,4-Triazole, 2-anilino-5-(methyl mercapto)-1-phenyl-, 2900⁸.
- C₁₅H₁₄O Acetaldehyde, phenyl-*p*-tolyl-, 3051³.
- Anisole, *p*-(α -methylenebenzyl)-, 909².
- Ethylene oxide, α -phenyl- β -*p*-tolyl-, 3051³.
- C₁₅H₁₄O₂ Benzoic acid, *p*-phenyl-, Et ester, 1453⁷.
- α -Toluic acid, benzyl ester, 2430⁶.
- C₁₅H₁₄O₂ Benzoic acid, *o*-(*o*-anisyl)-, Me ester, 2266⁴.
- Benzophenone, dimethoxy-, 81².
- 1,3-Butanedione, 1-(2-methoxy-1-naphthyl)-, 2472⁴.
- Lapachol, 1457³.
- Naphthoic acid, acetyldimethyl-, 1647⁴.
- 1,4-Naphthoquinone, 2- Δ^2 -pentenyloxy-, 1457⁴.
- C₁₅H₁₄O₂ 2-Indancarboxylic acid, 2-allyl-1,3-diketo-, Et ester, 3203².
- C₁₅H₁₄O₂ Methysticin, 2125², 2468⁸.
- Naphthalenediol, methoxy-, diacetate, 83⁸.
- 1,4-Naphthoquinone, 2-hydroxy-3-(β -hydroxypropyl)-, acetate, 241⁸.
- Phloracetophenone, α -*p*-anisyl-, 246².
- Piperic acid, α -acetyl-, Me ester, 2468⁸.
- C₁₅H₁₄O₈ β -Resorcylic acid, 5-[5-acetyl-5,6-dihydro-4 keto-6-methoxy-2-(1,4-pyranyloxy)]-, 1265⁸.
- C₁₅H₁₄N₄O₂S Benzothiazole, 1-[*m*(and *p*)-arsonophenyl]-5-dimethylamino-, 1985².
- C₁₅H₁₄BrClN Dibenzylamine, *p*-bromo-*p*'-chloro-*N*-methyl-, -HCl, 53².
- C₁₅H₁₄BrN₂O₄ 1-(γ -Hydroxypropyl)pyridinium bromide, *p*-nitrobenzoate, 1977⁸.
- C₁₅H₁₄ClN₂O₇ Benzylamine, *o*-chloro- α -*N*, *N*-dimethyl-, picrate, 54².
- C₁₅H₁₄Cl₂CrN₃, 3572².
- C₁₅H₁₄CoO₂N₂S + 21H₂O, 2232².
- C₁₅H₁₄CrF₃N₃, 3572².
- C₁₅H₁₄N Ethylamine, *N*-diphenylmethylene-, 3901⁴.
- C₁₅H₁₄NO Benzophenone, *p*-dimethylamino-, 3897⁸.
- 2-Propanone, 1,3-diphenyl-, oxime, 758².
- Propiophenone, β -(*m*-aminophenyl)-, 1799⁸.
- C₁₅H₁₄NO₂ Benzoin, α -methyl-, oxime, 3356¹.
- Phthalimidine, 2-*p*-anisyl-5,6-dihydro-, 2678⁴.
- C₁₅H₁₄NO₂S Indoline, 7-methyl-1-(phenylsulfonyl)-, 912⁷.
- C₁₅H₁₄NO₂ (See also *Saliphen*.)
- Anthranilic acid, *N*-*o*-phenetyl-, 1461⁸.
- 3-Pyranoquinolone, 7-acetyl-7,8,9,10-tetrahydro-8-methyl-, 411².
- 3-Pyrrolicarboxylic acid, 5-benzoyl-2-methyl-, Et ester, 382².
- 5-Quinaldineacrylic acid, 6-hydroxy-, Et ester, 3197⁷.
- 5-Quinoloneacrylic acid, 6-hydroxy-8-methyl-, Et ester, 3197⁸.
- C₁₅H₁₄NO₂S Sulfanilic acid, *N*-acetylthiol-, *p*-tolyl ester, 234⁴.
- C₁₅H₁₄NO₂ Acridinic acid, di-Et ester, 2697².
- Toluene, 4-benzyloxy-3-methoxy-6-nitro-, 1990².
- C₁₅H₁₄NO₂S Sulfilimine, *S*-(*m*-carboxyphenyl)-*S*-methyl-*N*-(*p*-tolylsulfonyl)-, 1253².
- C₁₅H₁₄NO₂S Cinnamic acid, *o*-sulfo-, acid aniline salt, 577².
- C₁₅H₁₄NO₂ Malonic acid, phthalimido-, di-Et ester, 3899².
- C₁₅H₁₄N₂O Acetanilide, *o*-formyl-, phenylhydrazones, 76².
- Acridine, diaminoethoxy-, P 2360⁷.
- 1(2)-Anthracenone, 3,4-dihydro-, semicarbazone, 1123².
- Glyoxal, phenyl-, *O*-methyloxime, phenylhydrazones, 1098².
- C₁₅H₁₄N₂O₂ Acridine, 3,7-diamino-2,8-dimethoxy-, P 593².
- Glyoxyloxyhydroxamic acid, *p*-tolyl-, phenylhydrazones, 743².
- Methyl red, 1773².
- C₁₅H₁₄N₂O₂ Benzoic acid, β -ethyl- β -(*p*-nitrophenyl)hydrazide, 1251².
- Indazole, tetrahydromethylnitrobenzoyl-, 2900⁴.
- Isoindazole, tetrahydromethylnitrobenzoyl-, 2900⁴.
- Pyruvohydroxamic acid, 1 naphthylhydrazones, Ac deriv., 743¹.
- Salicylaldehyde, β -ethyl- β -(*p*-nitrophenyl)hydrazones, 1251⁴.
- C₁₅H₁₄N₂O₂ Veratraldehyde, 5-hydroxy-, *p*-nitrophenylhydrazones, 78².
- C₁₅H₁₄N₂O₂ Δ^1 -Cyclohexaneglyoxylic acid, 2-hydroxy-, *o*-nitrobenzoylhydrazones-, 2900⁴.
- C₁₅H₁₄N₂S (See also *Azure B*.)
- Benzothiazole, 1-(aminophenyl)-5-dimethylamino-, 1985².
- C₁₅H₁₄N₂O₂ Benzylamine, α -dimethyl-*p*-nitro-, picrate, 1250⁷.
- Naphthyl'ine, tetrahydromethyl-, picrate, 586².
- C₁₅H₁₄N₂O₂ Acetanilide, α -amino-*N*-methyl-, picrate, 3355².
- C₁₅H₁₄N₂O₂ Glutaconic acid, α , γ -dicarbamyl-, di-Me ester, picrate, 3890².
- C₁₅H₁₄O₂P Phosphinecarboxylic acid, diphenyl-, Et ester, 3049⁷.
- C₁₅H₁₄BrN₂S β -Naphthothiazole, 2-butylamino-, tetrabromide, 584⁷.
- C₁₅H₁₄BrN₂S β -Naphthothiazole, 2-isobutylamino-, hexabromide, -HBr, 584⁸.
- C₁₅H₁₄Hg 2-Mesityl phenyl mercury, 233².
- C₁₅H₁₄IN Methylamine, *N*-diphenylmethylene-, methiodide, 3901⁴.
- C₁₅H₁₄IN₂O₂ Cyclopentanecarboxylic acid, 1-(3,5-diiodo-*p*-anisylazo)-2-keto-, Et ester, 90².
- C₁₅H₁₄N₂ Quinazoline, 5,6,7,8-tetrahydro-4-methyl-2-phenyl-, 3198².
- p*-Toluidine, *N*, *N*-dimethyl- α -phenylimino-, and -HCl, 403⁴.
- C₁₅H₁₄N₂O *p*-Acetotoluide, α -anilino-, 1801².
- Carbanilide, *o*,*o'*-dimethyl-, 239².
- Hydrocinnamamide, α -amino-, and -HCl, 3355¹.
- Indazole, benzoyltetrahydromethyl-, 2900⁴.
- Isoindazole, benzoyltetrahydromethyl-, 2900⁴.
- 4-Quinazolinol, 5,6,7,8-tetrahydro-7(=and 8)-methyl-2-phenyl-, 3198².
- , 5,6,7,8-tetrahydro-2-*p*-tolyl-, 3198².
- p*-Tolylhydroxamic acid, *p*-toluide, 1107¹.
- C₁₅H₁₄N₂O₂ *o*-Benzophenetide, *m*-amino-, 1451⁴.

- 3-Isindazolecarboxylic acid, 4,5,6,7-tetrahydro-1-phenyl-, methyl ester, 2899⁹.
- o*-Toluidine, *N*-(*o*-hydroxaminobenzyl)-, 1119⁷.
- p*-Toluidine, *N*-(α -nitromethylbenzyl)-, and salts, 2253⁸.
- C₁₁H₁₁N₃O₂S Carbanilide, dimethoxythio-, 671⁷, 1637⁸.
- C₁₁H₁₁N₃O₂ Carbazole, 9-acetyl-1,2,3,4-tetrahydro-6-methyl-5-nitro-, 91⁸.
- Hydracrylic acid, α , β -bis(*o*-aminophenyl)-, and *di-HCl*, 2260¹.
- 1-Imidazoleacetic acid, 4-benzal-4,5-dihydro-5-keto-2-methyl-, Et ester, 1813⁸.
- Pyrazole, 1-acetyl-3(or 5)-cresyl-5(or 3)-methyl-, acetate, 2471⁹, 2472².
- C₁₁H₁₁N₃O₆ Glyoxylohydroxamic acid, *p*-tolyl-, oxime, tri-Ac deriv., 733⁸, 734¹, 1976⁸.
- C₁₁H₁₁N₃O₂ Acetic acid, cyano(3,4,5-trimethoxy-2-nitrobenzoyl)-, Et ester, 912¹.
- C₁₂H₁₂N₂S Carbanilide, dimethylthio-, 67⁸, 671⁸.
- β -Naphthothiazole, 2-butylamino-, 584⁷.
- , 2-isobutylamino-, 584⁸.
- C₁₁H₁₁N₂O₂ Aniline, *p*,*p*'-methylenebis[*N*-methyl-*N*-nitroso-, 2891⁹.
- m*-Toluidine, *N*, *N*-dimethyl(*p*-nitrophenylazo)-, 903⁸.
- C₁₁H₁₁N₂O₂ *o*-Anisidine, *N*, *N*-dimethyl(*p*-nitrophenylazo)-, 903⁸.
- C₁₁H₁₁N₂O₈ 2-Naphthylamine, *N*-amyl-1,6,8-trinitro-, 404⁸.
- 2-Naphthylamine, *N*-isoamyl-1,6,8-trinitro-, 404⁸.
- C₁₁H₁₁N₂O₇ 2-Picoline, 5-isopropyl-, picrate, 2693⁸.
- C₁₁H₁₁O₂ Benzohydrol, *o*,*o*'-dimethyl-, 2266⁸.
- Phenol, *p*- α -ethylbenzyl-, 1982⁸.
- C₁₁H₁₁O₂ Toluene, 4-benzyloxy-3-methoxy-, 1990⁸.
- C₁₁H₁₁O₂ Artemisic acid, 1126⁸.
- Santenin, 2476⁸.
- C₁₁H₁₁O₄ Compd., m. 80°, from PhCH:CHCOCl and AcCHNaCO₂Et, 2902¹.
- Malonic acid, [a-(β , β -dihydroxy-*tert*-butyl)-benzyl]methyl-, diacetate, 3044⁸.
- C₁₁H₁₁O₂ See *Esculin*.
- C₁₁H₁₁AsIN 1-Ethyl-1,6-dihydro-1-1-methyl-1-phenarsazonium iodide, 1654¹.
- C₁₁H₁₁BrN₂O₂ 1-(γ -Hydroxypropyl)pyridinium bromide, *p*-aminobenzoate, 1977⁸.
- C₁₁H₁₁ClN₂O₂ Dimethyl(*o*-nitrobenzyl)phenylammonium chloride, 2884².
- C₁₁H₁₁N Dibenzylamine, *N*-methyl-, 73⁸.
- Quinoline, 2-cyclohexyl-, 914⁸.
- p*-Toluidine, *N*-benzyl-*N*-methyl-, 65⁸.
- C₁₁H₁₁NO Carbazole, 9-acetyl-1,2,3,4-tetrahydro-6-methyl-, 91⁸.
- 1-Propanol, 3-amino-1,3-diphenyl-, 3888².
- C₁₁H₁₁NO₂ Isocarbazolol, tetrahydromethyl-, acetate, 91⁸.
- Phthalimidine, 2-*p*-anisyltetrahydro-, 2677⁷, 2678⁸.
- Spiro[cyclohexane-1,2'-pseudoindoxyl], 1'-acetyl-, 2882⁴.
- Spiro[cyclopentane-1,2'-pseudoindoxyl], 1'-acetyl-5'-methyl-, 91⁸.
- C₁₁H₁₁NO₂S α -Toluenesulfonanilide, *N*-ethyl-, 99⁴.
- C₁₁H₁₁NO₂S α -Toluenesulfono-*p*-phenetide, 99⁴.
- C₁₁H₁₁NO₂ Cinnamic acid, *o*-nitro-, cyclohexyl ester, 2903¹.
- C₁₁H₁₁NO₂S Valeric acid, β -(2-naphthylsulfonamido)-, 57⁸.
- C₁₁H₁₁NO₂ 2-Indolecarboxylic acid, 3- β -glucosid-oxy-, 3602⁸.
- C₁₁H₁₁N₃ Guanidine, ditolyl-, 672⁸, 4.
- C₁₁H₁₁N₂O 2-Butanone, 4-(2-naphthyl)-, semicarbazone, 97².
- C₁₁H₁₁N₂O₈ Semicarbazide, 4-*o*-anisylthio-2-*p*-tolyl-, 3200⁸.
- C₁₁H₁₁N₂O₂ Benzoic acid, 5-amino-2-(*p*-dimethylaminoanilino)-, 2259⁸.
- Guanidine, di-*p* anisyl-, 672⁴.
- Hydrazine, α -(α -nitromethylbenzyl)- β -*p*-tolyl-, 2253⁹.
- 3-Pyrrolecarboxylic acid, 5-formyl-2-methyl-, Et ester, phenylhydrazone, 381³.
- C₁₁H₁₁N₂O₂ Sarcosine, addn. compd. with *p*-phenylazophenol, 68⁸.
- C₁₁H₁₁N₂O₄ Hydrazine, α -[2-(hydroxymethylene)-6-methylcyclohexylidene]- β -(*o*-nitrobenzoyl)-, 2900⁸.
- C₁₁H₁₁N₂S Semicarbazide, thio-4-*m*-tolyl 2-*p*-tolyl-, 3200⁸.
- C₁₁H₁₁N₂O₂ Carbamic acid, mesoxalylbis-, di-Et ester, nitrophenylhydrazone, 1654².
- C₁₁H₁₁N₂O₂S 4(or 5)-Imidazolecarboxylic acid, 2-(ethylmercaptop)-5(or 4)-methyl-, Et ester, picrate, 3614⁸.
- C₁₁H₁₁OP Phosphine oxide, benzylethylphenyl-, 66⁸.
- C₁₁H₁₁BiF₂N₃ Pyridinium hexaiodobismuthite, 2855⁸.
- C₁₁H₁₁BrN₂ Isopyrrole, 5-bromo-2-[5-bromo-3-ethyl-4-methyl-2-pyrrolyl)methylene]-3-ethyl 4-methyl-, and -HBr, 2701⁸.
- C₁₁H₁₁ClNO Benzylethylhydroxyphenylammonium chloride, 65⁸.
- Benzylhydroxymethyl-*p*-tolylammonium chloride, 66¹.
- C₁₁H₁₁ClP Benzylidimethylphenylphosphonium chloride, 66¹.
- C₁₁H₁₁N₂ Aniline, *p*,*p*'-methylenebis[*N*-methyl-, 2891⁹.
- C₁₁H₁₁N₂O₂ Pyrazoledione, acetyldiethylphenyl-, 1320².
- 2-Quinoxalinepropionic acid, 3,4-dihydro-3-keto- α , β , β tetramethyl-, 1967⁸.
- C₁₁H₁₁N₂O₂ Glycine, *N*-(α -acetamidocinnamyl)-, Et ester, 1813⁸.
- 2-Indenebicarbanic acid, di-Et ester, 1124¹.
- 2-Pyrrolecarboxylic acid, 5,5'-methylenebis-[3,4-dimethyl-, 85⁸.
- C₁₁H₁₁N₂O₂ 2-Indolecarboxamide, 3- β -glucosid-oxy-, 3602⁸.
- C₁₁H₁₁N₂S Urea, α -butyl- β -1-naphthylthio-, 584⁸.
- Urea, α -isobutyl- β -1-naphthylthio-, 584⁸.
- C₁₁H₁₁N₂O Carbanilide, 4,4'-diamino-3,3'-dimethyl-, P 2478⁴.
- C₁₁H₁₁N₂O₈ Carbamic acid, mesoxalylbis-, di-Et ester, phenylhydrazone, 1654².
- C₁₁H₁₁N₂O₇ Ornithine, γ -hydroxy-, lactone, picrolonate, 62⁸.
- C₁₁H₁₁O Ether, 7-ethyl-1,4-dimethyl-2-naphthyl methyl, 1127¹.
- Δ^2 , Δ^4 -Octadienone, 6-phenyl-(?), 229⁷.
- C₁₁H₁₁O₂ Camphor, 3-(2-fural)-, 86⁸.
- C₁₁H₁₁O₂ (See also *Santenin*.)
- Artemisic acid, dihydro-, 1126⁸.
- Cyclohexanepropionic acid, 2-keto- β -phenyl-, 231⁴.
- Cyclohexanone, 2-(α -hydroxybenzyl)-, acetate, 231².
- C₁₁H₁₁O₂ Acetoacetophenone, 2-hydroxy- α , α ,3-trimethyl-(?), acetate, 1117⁸.

- 4-Chromanone, 2-hydroxy-2,3,8-tetra-methyl-(?), acetate, 1117².
- Cyclohexanol, methyl-, acid phthalate, 374², 375², 375^{1,4}.
- Hydrocinnamic acid, β -(β , β -dihydroxy-*tert*-butyl)-, lactone, acetate, 3044².
- , β -(α -formylisopropyl)-, mixed anhydride with AcOH, 3044².
- Malonic acid, β -(1,2,3,4-tetrahydro-1-naphthyl)ethyl-, 2684³.
- Santeninic acid, 2476³.
- C₁₅H₁₈O₈ Malonic acid, α -(α -formylisopropyl)-benzyl-, mono-Me ester, 3044¹.
- C₁₅H₁₈O₇ Pyruvic acid, 2,4,6-trimethoxybenzoyl-, Et ester, 3621¹.
- C₁₅H₁₈N Cyclohexylamine, *N*-cinnamal-, 2882⁵.
- C₁₅H₁₈N₂ (See also *Tropacocaine*.)
- β -Butenic acid, α -(amylimino)- γ -phenyl-, 2882⁷.
- Cyclohexanone, 1,3-dimethyl-, oxime, Bz deriv., 230⁷.
- Spiro[1,4-benzopyran-4,1'-cyclohexane]-3-nitrile, 2,3,5,6,7,8-hexahydro-2-keto-, 1103².
- C₁₅H₁₈N₂O₄ 4a,9a-Carbazolediol, 9 acetyl-1,2,3,4-tetrahydro-6-methyl-, 915².
- Hydrohydrastinine, 1-acetonyl-3-methyl-, 1900².
- C₁₅H₁₈N₂O₆ Malonic acid, (α -aminopiperonyl), di Et ester, *ICI*, 1978³.
- C₁₅H₁₈N₂O Pyrrole, isomethylphenylazo-, 2451³.
- C₁₅H₁₈N₂O 7(8)-Cycloheptanaphthene, 1,2,3,9,10,10a-hexahydro-, semicarbazone, 2684³.
- Pyrrole, anisylazo-1-butyl-, 2451³.
- C₁₅H₁₈N₂O₂ 2,5-Piperazinedione, 1,4-dimethyl-, methylindole addn. compd., 1797².
- C₁₅H₂₀ Cyclohexane, 1,1-dimethyl-3-methylene-2-phenyl-, 738¹.
- 1,5-Heptadiene, 2-benzyl-6-methyl-, 50⁸.
- C₁₅H₂₀Hg₂O₈ Phenol, 2,6 bis(acetoxymercuri)-4-isoamyl-, 69⁸.
- C₁₅H₂₀INO₂ 6-Ethoxy-1-ethyl-2- β -hydroxyethyl-quinolinium iodide, 3201⁴.
- C₁₅H₂₀N₂ Cinnamaldehyde, cyclohexylhydrazone, -*ICI*, 1802³.
- Isopyrrole, 3,4,5-trimethyl-2-(3,4,5-trimethyl-2-pyrrolmethylene)-, and salts, 85².
- C₁₅H₂₀N₂O₂ 2,5-Piperazinedione, 3-benzyl-6-iso-butyl-, 1965⁹.
- C₁₅H₂₀N₂O₄ Glycine, *N*-(*N*-acetyl- β phenylalanyl)-, Et ester, 61⁵.
- Glycine, *N*-(α -benzamidoisobutyl)-, Et ester, 1813⁶.
- 1-Piperidinepropanol, *p*-nitrobenzoate, -*ICI*, 1977⁸.
- C₁₅H₂₀N₂O₇ Isoquinoline, decahydro, picrate, 587¹.
- Quinoline, decahydro-, picrate, 2903⁴.
- C₁₅H₂₀N₂O₄ Δ^5 -2-Hexenone, 4-(dimethylamino-methyl)-, picrate, 1121⁴.
- C₁₅H₂₀O₂ Anisole, 2,4-dimethyl-6-(β -methylpentadienyl)-, 71⁵, 72¹.
- C₁₅H₂₀O₂ Camphor, 3-(furylmethyl)-, 86², 1116⁵.
- C₁₅H₂₀O₂ Hydrocinnamic acid, β -(β , β -dihydroxy-*tert*-butyl)- α -ethyl-, lactone, 3044².
- Santonosic acid, and Ba salt, 1126⁵, 1127^{1,2}.
- C₁₅H₂₀O₄ Caprylic acid, salicylate, 132⁸.
- Malonic acid, *p*-methylbenzyl-, di-Et ester, 1646².
- C₁₅H₂₀O₇ Glucoheptoside, β -vanillin- α -, 2252³.
- C₁₅H₁₈AlO₈ 2,4-Pentanedione, aluminum deriv., 2405⁴.
- C₁₅H₂₁AsN₂O₈ Carbamic acid, [[[*p*-arsonophenylcarbamyl)methyl]carbamylmethyl]carbamylmethyl]-, Et ester, 71¹.
- C₁₅H₂₁ClO₂Zr Compd. from ZrCl₄ and acetyl-acetone, 1069⁴.
- C₁₅H₂₁EuO₈ + 3H₂O Europium deriv. of acetyl-acetone, 1602⁴.
- C₁₅H₂₁N Indole, 3-heptyl-, 1262⁷.
- Quinoline, 2-cyclohexyl-1,2,3,4-tetrahydro-, 915¹.
- C₁₅H₂₁NO *p*-Acetotoluide, *N*-cyclohexyl-, 1102⁴.
- Benzamide, *N*-(3,5-dimethylcyclohexyl)-, 230^{8,9}.
- Butyrophenone, γ -1-piperidyl-, 2271¹.
- Morphopiperidine, *N*-*p*-methylbenzyl-, 412⁷.
- Penteno-*p*-toluide, α -ethyl- β -methyl-, 3187⁸.
- C₁₅H₂₁NO₂ See *Eucaine*.
- C₁₅H₂₁NO₃ Cyclopentanecetic acid, α -cyano-1-(2-ketocyclopentyl)-, Et ester, 1103³.
- Ethanol, 2-(β -dimethylaminoethoxy)-, cin-namate, 3889⁹.
- Hydrocinnamic acid, α -ethyl- β -(α -formylisopropyl)-, oxime, 3044².
- 2-Piperidone, 3-ethyl-1,6-dihydroxy-5, β -dimethyl-4-phenyl-, 3044⁶.
- 1-Propanol, 1-(3,4-methylenedioxyphenyl)-2-(1-piperidyl)-, and salts, 2271¹.
- C₁₅H₂₁NO₄ *m*-Toluidine, *N*-cyclohexyl-, oxalate, 1102⁹.
- C₁₅H₂₁N₂O Δ^4 -2-Hexenone, 3-ethyl-4-phenyl-, semicarbazone, 220⁷.
- C₁₅H₂₁N₂O₂ See *Physostigmine*.
- C₁₅H₂₁N₂O₂ Δ^2 -2-Butenone, 4-(4-isopropoxy-*m*-anisyl), semicarbazone, 3612².
- Geneserine, 915⁶.
- C₁₅H₂₁N₂O₃ Guanidine, γ -ethyl- α , α -dimethyl-, picronate, 62⁹.
- C₁₅H₂₁N₂O₂ Benzoic acid, *p*-amino-, dimethylamino-cyclohexyl ester, 1977⁴.
- 1-Piperidinepropanol, *p*-aminobenzoate, -*ICI*, 1977⁸.
- Propionamide, α -benzamido-*N*-isoamyl-, 1657⁷.
- C₁₅H₂₁N₂O₂ Glutaric acid, α -(*o*-aminoanilino)- α -hydroxy- β , β , γ , γ -tetramethyl-, 1967⁷.
- C₁₅H₂₁N₂O₄ Benzamide, *N*,*N*-diethyl-*o*-(*m* and *p*)-propionyl-, semicarbazone, 1980^{7,8}.
- C₁₅H₂₁N₂O₄ Cyclopentanethanol, β -dimethylamino-, picrate, 59⁴.
- 2-Propanol, 2-methyl-1-(1-piperidyl)-, picrate, 2271¹.
- C₁₅H₂₁O Ether, benzyl 2,4-dimethylcyclohexyl-, 737⁹.
- C₁₅H₂₁O₂ Cyclohexanol, *p*-(*p*-hydroxy- α , α -dimethylbenzyl)-, P 227³.
- Dehydrogaiene dioxide, 2204².
- Isodehydrogaiene dioxide, 2264⁴.
- Isovalerophenone, 4-hydroxy-5-isopropyl-2-methyl-, 1974⁴.
- C₁₅H₂₁O₃ Kessyl ketone, hydroxymethylene-, 3361⁷.
- Ngaione, 2263⁷.
- C₁₅H₂₁O₃ 1,1,2,2-Cyclopropanetetracarboxylic acid, tetra-Et ester, 1249⁷.
- Δ^1 -1,1,3,8-Propenetetracarboxylic acid, tetra-Et ester, 1100⁸.
- C₁₅H₂₁O₆ Glucose, monoacetone-triacetyl-, 64¹.
- C₁₅H₂₁O₈ *d*-Glucose, 3-methylthio-, tetra-acetate, 1634⁴.
- C₁₅H₂₁O₁₁ Fructoside, tetracarbomethoxy-methyl-, 2880^{2,3}.
- C₁₅H₂₁N Cyclohexylamine, *N*-(γ -phenylpropyl)-, and -*ICI*, 2882⁵.

- $C_{11}H_{22}NO$ 2-Butanone, 3-benzyl-4-diethylamino-, 1121¹.
- $C_{11}H_{22}NO_2$ Amylamine, *N*-[γ -(3,4-methylene-dioxyphenyl)propyl]-, and -HCl, 2882².
1-Butanol, 3-amino-2,2-diethyl-, benzoate, -HCl, 3347⁴.
Butyric acid, α -(amylamino)- γ -phenyl-, 2882².
Glycine, *N*- α -phenylamyl-, Et ester, and -HCl, 2890³.
Isovalerophenone, 4-hydroxy-5-isopropyl-2-methyl-, oxime, 1974⁶.
Piperidine, 2,6-bis(hydroxymethyl)-1- β -methylbenzyl-, 413¹.
Valeric acid, α -dimethylamino- δ -phenyl-, Et ester, 59².
- $C_{11}H_{22}NO_4$ Ethanol, 2-[β -(β -dimethylaminoethoxy)ethoxy]-, benzoate, 3889⁶.
- $C_{11}H_{22}NO_6$ Benzylamine, α -*tert*-butyl-, acid tartrate, 3346⁹.
- $C_{11}H_{22}N_2O_2$ Benzaldehyde, β -dimethylamino, cyclohexylhydrazone peroxide, 1802².
Isovalerophenone, 4-hydroxy-3-propyl-, semicarbazone, 1974⁷.
- $C_{11}H_{22}N_2O_3$ Arginine, *N* α -(β -phenylalanyl)-, and di-HCl, 2877^{2,3}.
- $C_{11}H_{22}N_2O_5$ Acetamide, α -dimethylamino-*N*-isomyl-, picrate, 1657⁷.
2-Butanone, 4-dimethylamino-3-dimethylaminomethyl-, picrate, 1121¹.
Isocaproamide, *N*-ethyl- α -methylamino-, picrate, 1657⁷.
- $C_{11}H_{24}$ Cadinene, 577⁶, 2555⁷.
Caryophyllene, 236⁶, 1108⁹.
Compd., b.p. 183-95°, from geraniol, 1962².
Elemene, 577⁶.
Isocadinene, 577⁶.
- $C_{11}H_{12}Br_2N_2O_6$ Pyridazine, 4,5-dibromo-1,2-bis-[(carboxymethyl)carbonyl]hexahydro-4-methyl-, di-Et ester, 1123⁹.
- $C_{11}H_{12}HgO$ Compd., m. 122°, from caryophyllene, 236⁶.
- $C_{11}H_{12}HgO_7$ Undecylic acid, bis(acetoxymercuri)keto-, *Hg salt*, 3348⁹.
- $C_{11}H_{12}INO_2$ 2,5-Bis(hydroxymethyl)-1-methyl 1- β -methylbenzylpyrrolidinium iodide, 412⁹.
Triethyl(β -hydroxyethyl)ammonium iodide, benzoate, 2249¹.
- $C_{11}H_{12}INO_4$ 5,5-*m*-Dioxanedicarbinol, 2-(β -dimethylaminophenyl)-, methiodide, 895⁶.
- $C_{11}H_{14}N_2$ Cadaverine, *N*-(1,2,3,4-tetrahydro-2-naphthyl)-, and di-HCl, 566⁶.
- $C_{11}H_{12}N_2O_6$ α -Glucoseptose, ethylphenylhydrazone, 2879⁶.
- $C_{11}H_{12}N_2O_7$ Pyridazine, 1,2-bis[(carboxymethyl)carbonyl]-1,2,3,6-tetrahydro-4-methyl-, di-Et ester, 1123⁹.
- $C_{11}H_{12}N_2O_7$ Diethylamine, *N*-(α -ethylpropyl)-, picrate, 3346¹.
- $C_{11}H_{12}N_2O_8$ 2-Butanol, 1-(β -dimethylaminoethoxy)-2-methyl-, picrate, 3889⁷.
- $C_{11}H_{14}O$ Thymol, 6-isomyl-, 1974⁷.
- $C_{11}H_{14}O_2$ Ngaiol, 2263⁷.
- $C_{11}H_{14}BrHgO$ Compds., m. 73° and 99°, from caryophyllene, 236⁶.
- $C_{11}H_{12}Br_2NO_2$ Spiro[piperidine-1,1'-pyrrolidine]-3'-carboxylic acid, 3'-acetyl-*N*-bromo-5-(bromomethyl)-, Et ester, 1813¹.
- $C_{11}H_{12}ClHgO$ Compds., m. 94° and 127°, from caryophyllene, 236⁶.
- $C_{11}H_{12}ClIN_2O_3$ Compd., m. 143°, from caryophyllene, 237¹.
- $C_{11}H_{12}FHgO$ Compd., sinters 60°, from caryophyllene, 236⁶.
- $C_{11}H_{12}HgIO$ Compds., m. 96° and 146.5°, from caryophyllene, 236⁶.
- $C_{11}H_{12}NO$ Compd., m. 58°, from caryophyllene, 237¹.
- $C_{11}H_{12}N$ Amylamine, *N*- γ -*p*-tolylpropyl-, and -HCl, 2882².
- $C_{11}H_{12}NO_2$ 2-Butanol, 3-benzyl-4-diethylamino-, 1121¹.
- $C_{11}H_{12}NO_2$ Ngaiylamine, and salts, 2264².
- $C_{11}H_{12}NO_2S$ α -Toluenesulfonamide, *N*, *N*-di-butyl, 99⁴.
- $C_{11}H_{12}NO_3$ 1-Piperidinepropionic acid, α -acetyl- α -allyl-, Et ester, 1813¹.
- $C_{11}H_{12}NO_4$ 2-Propanone, 1-amino 1-phenyl-, di-Et acetal, acetate, 75⁷.
2,4-Quinolinedicarboxylic acid, decahydro-, di-Et ester, and chloroplatinate, 1815².
- $C_{11}H_{12}N_2O_2$ 1(2)-Naphthalenone, octahydro-7-isopropylidene-4a-methyl-, semicarbazone, 2880¹.
- $C_{11}H_{12}Br_2O$ Cubehol, dibromide, 577¹.
- $C_{11}H_{12}N_2$ (See also *Sparteine*.)
1,12-Dodecanedinitrile, 2-methyl-, 3349⁶.
- $C_{11}H_{12}N_2O$ Quinoline, 2-cyclohexyldecahydro-1-nitroso-, 914⁶.
- $C_{11}H_{20}O$ Cubehol, 577¹.
Cyclopentanol, 2-(2-cyclopentylcyclopentyl)-(?), 900⁴.
Elemol, 577⁶.
Eudesmol, 2888⁶.
Farnesol, 290¹, 2528⁷.
Nerolidol, P 3008⁹.
- $C_{11}H_{20}O_2$ Δ^2 -Cyclopentenone, 3-hydroxy-2,5-di-isomyl-, 399².
Isovaleric acid, hornyl ester, 2682⁴; isobornyl ester, 2682⁴.
Valeric acid, geranyl ester, 1407⁶.
- $C_{11}H_{20}O_3$ Ngaiol, dihydro-, 2263⁷.
Ngaione, tetrahydro-, 2263⁷.
- $C_{11}H_{20}O_4$ Pimelic acid, β -hydroxy- β -isomyl- γ -methyl-, lactone, Et ester, 578¹.
- $C_{11}H_{20}O_6$ Butyryn, 1277⁶, 2324², 3221².
Mannitol, triacetone, 1798¹.
- $C_{11}H_{20}O_6P$ Compd., softens 84-5°, from caryophyllene, 236⁶.
- $C_{11}H_{12}N$ Quinolinc, 2-cyclohexyldecahydro-, 914⁶.
- $C_{11}H_{12}NO_4$ α -Hydromuconic acid, δ -diethylamino- β -methyl-(?), di-Et ester, 60⁴.
- $C_{11}H_{12}N_2O_2$ 1(2)-Naphthalenone, octahydro-7-hydroxy-7-isopropyl-4a-methyl-, emicarbazone, 2888⁶.
- $C_{11}H_{12}$ Tetrahydro deriv., b.p. 175-80°, of compd. from geraniol, 1962².
- $C_{11}H_{12}N_2O_5S$ Pseudothiohydantoin, 5-dodecyl-, 3045⁹.
- $C_{11}H_{12}N_2O_7$ Ngaione, tetrahydro-, hydrazone, 2264².
2(1)-Pyrimidone, 4,6-epoxy-4,5,6-triethyl-tetrahydro-5-isomyl-(?), 3351¹.
- $C_{11}H_{12}N_2O_7$ Betaine, m. 185-6°, from leucylproline, 390⁴.
- $C_{11}H_{12}O_2$ Cyclohexanol, β , β' -isopropylidenebis-, P 2273⁹.
Ngaione dioxide, tetrahydro-, 2264².
Pentadecenic acid, 2873⁹, 2874¹.
Tridecenic acid, ethyl ester, 2873⁹.
 λ -Tridecenic acid, α -methyl-, methyl ester, 2873⁹.
 Δ^{12} -1-Tridecenol, acetate, 2873⁹.
- $C_{11}H_{12}O_3$ Ngaiol, tetrahydro-, 2263⁷.
Pentadecic acid, ν -keto-, 2874¹.
Tridecic acid λ -keto- α -methyl-, methyl ester, 2873⁹.

- C₁₅H₂₅O₄** Brassylic acid, α (and β)-methyl-, Me ester, 3349².
 1,10-Decanedicarboxylic acid, 1(and 2)-methyl-, Et ester, 3349².
 1,12-Dodecanedicarboxylic acid, 2-methyl-, 3349².
 1,13-Tridecanedicarboxylic acid (?), 2458⁶.
C₁₅H₂₅Br 1-Pentadecene, 15-bromo-, 2874¹.
C₁₅H₂₅NO Ngaiylamine, tetrahydro-, 2263³.
C₁₅H₂₅NO₂ Malonic acid, (δ -diethylaminobutyl)-, di-Et ester, 3355⁷.
C₁₅H₂₅ Cyclopentane, 1,3-diisooamyl-, 390³.
C₁₅H₂₅NO₂ Spiro[piperidine-1,1'-homopiperazine - 4',1'' - piperidine], *N*, *N'* - dihydroxy-, bischloroaurate, 1653⁴.
C₁₅H₂₅Br₂ Pentadecane, 1,14-dibromo-, 2874¹.
 Tetradecane, 1,14-dibromo-3-methyl-, 3349².
C₁₅H₂₅Br₂N₂ Spiro[piperidine-1,1'-homopiperazine - 4',1'' - piperidine], *N*, *N'* - dihydroxy-, dibromide, 1653⁴.
C₁₅H₂₅Cl₂N₂ Spiro[piperidine-1,1'-homopiperazine - 4',1'' - piperidine], *N*, *N'* - dihydroxy-, dichloride, 1653⁴.
C₁₅H₂₅Cl₂N₂Pt Spiro[piperidine - 1,1' - homopiperazine - 4',1'' - piperidine], *N*, *N'* - dihydroxy-, chloroplatinate, 1653⁴.
C₁₅H₂₅N₂ Piperidine, 1,1'-pentamethylenebis-, 409⁹.
C₁₅H₂₅N₂O₄ Pimelic acid, α , ϵ -bis(diethylamino)-, 60⁷.
C₁₅H₂₅O Pentadecanol, 2874¹.
C₁₅H₂₅O₂ Myristic acid, methyl ester, 2874¹.
 Pentadecanoic acid, 13⁷.
C₁₅H₂₅O₂ Oxido-glycol, b. n. 217-20°, from ngaiol, 2264¹.
 η -Pentadecanoic acid, ξ -hydroxy-, 2118⁹.
C₁₅H₂₅NO₂ Alanine, *N*, *N*-diisooamyl-, Et ester, 60⁸.
C₁₅H₂₅Hg₂I₂N₂S₂ Compd. from Hg deriv. of 3,6-dihydro-2,4-s-triazinedimercaptan and EtI, 1101².
C₁₅H₂₅N₂O Isocaproamide, *N*-ethyl- α -heptylamino-, 1657⁹.
C₁₅H₂₅O₂ Enanthaldehyde, diisobutyl acetal, 3608³.
 1,14-Pentadecanediol, 2874¹.
 1,4-Tetradecanediol, 3-methyl-, 3349².
C₁₅H₂₅O₂Pb Triethyllead pentargonate, 1445².
C₁₅H₂₅O₂S₂ Galactose, pentamethyldiethyl mercapto-, 3891².
 Mannose, pentamethyldiethylmercapto-, 3891².
C₁₅H₂₅Br₂N₂O₂ Δ^2 -3-Pyrazolinecarboxylic acid, 1-(2,4-dibromophenyl)-4,5-diketo-, 4-(2,4-dibromophenyl)hydrazone, 2899⁴.
 Succinic anhydride, diketo-, 2,4-dibromophenylosazone, 2899⁴.
C₁₅H₂₅Br₂S Thiophene, diphenyl-, tetra- Br deriv., 3903⁷.
C₁₅H₂₅Cl₂N₂O₂ Δ^2 -3-Pyrazolinecarboxylic acid, 1-(2,4-dichlorophenyl)-4,5-diketo-, 4-(2,4-chlorophenyl)hydrazone, 2899⁴.
 Succinic anhydride, diketo-, 2,4-dichlorophenylosazone, 2899⁴.
C₁₅H₂₅Br₂N₂O₂ 2-Naphthylamine, *N*-(bromophenyl)-1,6,8-trinitro-, 404⁷.
C₁₅H₂₅Cl₂N₂O₂ 2-Naphthylamine, *N*-(chlorophenyl)-1,6,8-trinitro-, 404⁷.
C₁₅H₂₅ClO₄ Anthraquinone, 2-chloro-1(and 3)-hydroxy-, acetate, 1813².
C₁₅H₂₅I₂N₂O₂ 2-Naphthylamine, *N*-(iodophenyl)-1,6,8-trinitro-, 404⁷.
C₁₅H₂₅NO₂ Quinaldine, C₂O₂ addn. compd., 735².
C₁₅H₉NO Coumarin, 3-benzoyl-6-nitro-, 378⁷.
C₁₅H₉N₂O₂ 4,5- $\alpha\beta$ -Isonaphthotriazolidone, 1-phenyl-, 742¹.
C₁₅H₉N₂O₂S 3-Oxidazinoindolemercaptan, benzoate, 3199².
C₁₅H₉N₂O₂ 4,9- $\beta\beta$ -Naphthotriazolidone, dihydroxy-2-phenyl-, 2268⁹.
C₁₅H₉N₂O₂S Thiophene, 2,5-diphenyl-, trinitro deriv., 3903⁷.
C₁₅H₉N₂O₂ Ether, phenyl 1,6,8-trinitro-2-naphthyl-, 404⁷.
C₁₅H₉N₂O₂ 2-Naphthylamine, 1,6,8-trinitro-*N*-(nitrophenyl)-, 404⁷.
C₁₅H₉BrClN₂ (Bromophenylazo)-1-naphthalenediazonium chloride, 380⁶.
C₁₅H₉BrN₂ Imidazo[5,4- η]quinoline, 4-bromo-2-phenyl-, 2691⁵.
C₁₅H₉Br₂Cl₂O₂ 1,4-Butanedione, 1,4-bis(bromophenyl)-2,3-dichloro-, 824¹.
C₁₅H₉Br₂N₂O₂ Δ^2 -3-Pyrazolinecarboxylic acid, 1-(*p*-bromophenyl)-4,5-diketo-, 4-*p*-bromophenylhydrazone, 2899⁴.
 Succinic anhydride, diketo-, *p*-bromophenylosazone, 2899⁴.
C₁₅H₉Br₂O Furan, 3,4-dibromo-2,5-diphenyl-, 824¹.
C₁₅H₉Br₂O₂ Δ^2 -1,4-Butenedione, 1,4-bis(bromophenyl)-2 hydroxy-, 82⁹.
C₁₅H₉Br₂O₂ Fumaric acid, di-*p*-bromophenyl ester, 2893⁴.
C₁₅H₉Br₂N₂O₂ Succinic acid, diketo-, 2,4-dibromophenylosazone, 2899⁴.
C₁₅H₉Br₂O₂ 1,4-Butanedione, 2,3-dibromo-1,4-bis(bromophenyl)-, 824¹.
C₁₅H₉ClN₂O₂ Anthraquinone, 1-acetamido-6(and 7)-chloro-, 1812³.
C₁₅H₉ClN₂O Berberoline, chloride, 1989⁹.
C₁₅H₉ClN₂ Imidazo[5,4- γ]quinoline, 4-chloro-1-phenyl-, 2691⁵.
C₁₅H₉ClN₂O₂ (Nitrophenylazo)-1-naphthalenediazonium chloride, 380⁶.
C₁₅H₉Cl₂N₂O₂S Phenol, 3,3'-dithiobis[6-chloro-4-nitro-, diacetate, 2692³.
C₁₅H₉Cl₂N₂ (Chlorophenylazo)-1-naphthalenediazonium chloride, 380⁶, 1113⁹.
C₁₅H₉Cl₂N₂O₂ Δ^2 -3-Pyrazolinecarboxylic acid, 1-(*p*-chlorophenyl)-4,5-diketo-, 4-*p*-chlorophenylhydrazone, 2899⁴.
 Succinic anhydride, diketo-, *p*-chlorophenylosazone, 2899⁴.
C₁₅H₉Cl₂O₂ Fumaric acid, di-*p*-chlorophenyl ester, 2893⁴.
C₁₅H₉Cl₂N₂O₂ Succinic acid, diketo-, 2,4-dichlorophenylosazone, 2899⁴.
C₁₅H₉CuN₂O₂ 1,2,4-Oxadiazol-3-ol, 5-phenyl-, Cu deriv., 1976⁴.
C₁₅H₉INO₂ Cinchoninic acid, 1,2-dihydro-6-iodo-2-keto-3-phenyl-, 586².
C₁₅H₉N₂ α -Benzophenazine, 1815⁴.
C₁₅H₉N₂O 9- α -Benzophenazinol, 1815⁴.
C₁₅H₉N₂O₂ See *Indigotin*.
C₁₅H₉N₂O₂ Glyoxime, dibenzoyl-, peroxide, 1099⁴.
C₁₅H₉N₂O₂S Thiophene, 2,5-diphenyl-, dinitro deriv., 3903⁷.
C₁₅H₉N₂O₂ Fumaric acid, di-*p*-nitrophenyl ester, 2893⁴.
C₁₅H₉N₂O₂ 2(1)-Pyrazinone, 3,6-bis[*m*(and *p*)-nitrophenyl]-, 1984².
C₁₅H₉N₂O₂ 2-Naphthylamine, 1,6,8-trinitro-*N*-phenyl-, 404⁷.
C₁₅H₉OS 3,2- α -Anthrathiophen-1(2)-one, P 415⁴.
C₁₅H₉O₂ Benzoic acid, 3-benzoyl-, 3192⁹.

- Coumarin, 3-benzoyl-7-hydroxy-, 378^a.
 Flavone, 3',4'-methylenedioxy-, 3194^a.
 C₁₆H₁₀O₄ Flavone, 3-hydroxy-3',4'-methylenedioxy-, 3194^a.
 1,4-Naphthoquinone, 2-(3,4,5-trihydroxyphenyl)-, 2887^a.
 C₁₆H₁₀O₆ 2,5-Anhydromannonic acid, 3892¹.
 C₁₆H₁₁AgN₄O₄ 1,2,4-Oxadiazol-3-ol, 5-phenyl, compd. with its Ag deriv., 1976^a.
 C₁₆H₁₁AsClN α -Benzophenarsazine, 12-chloro-7,12-dihydro-, 98^a.
 C₁₆H₁₁BrCl Anthracene, 9-(α -bromoethyl)-1,5-dichloro-, 1261^a.
 C₁₆H₁₁BrN₂O₃ 1-Naphthalenediazosulfonic acid, (bromophenylazo)-, *Na salts*, 380^a.
 C₁₆H₁₁BrO₄ Glutaconic anhydride, α -bromo- γ -cinnamal- β -hydroxy-, acetate, 1798^a.
 C₁₆H₁₁Br₂N₂O₃ Diacetanilide, 2,6-dibromo-4-(dinitrophenyl)-(?), 1109^a.
 C₁₆H₁₁Br₂Cl Anthracene, 9,10-dibromo-9-(α -bromoethyl)-1,5-dichloro-9,10-dihydro-, 1261^a.
 C₁₆H₁₁ClN₂O₃ 1-Naphthalenediazosulfonic acid, (chlorophenylazo)-, *Na salt*, 380^a, 1114¹.
 C₁₆H₁₁ClN₂O₇ Quinaldine, chloro-, picrate, 1651^a.
 C₁₆H₁₁ClO Furan, 3-chloro-2,5-diphenyl-, 82^a.
 C₁₆H₁₁Cl₂N₂O₃ Quinoline, 2-chloro-3-(*p*-chlorophenylsulfonyl)-8-methoxy-, 1122^a.
 C₁₆H₁₁Cl₂N₂O₃ 1,3-Benzodioxan-6-sulfonanilide, 2,4-bis(trichloromethyl)-, 3607¹.
 C₁₆H₁₁NO γ -Benzocarbazolol, 1651^a.
 C₁₆H₁₁NO₂ (See also *Cinchophen*).
 Benzoic acid, *p*-2-quinolyl-, 2695^a.
 Isoquinoline, 6,7-methylenedioxy-1-phenyl-, 1462^a.
 1,2,6-Oxazin-6-one, 3,5-diphenyl-, 583^a.
 Phthalimide, *N*-styryl-, 1462^a; and -*II* Br, 1655^a.
 Quinolinedicarboxylic acid, phenyl-, 2695^a.
 C₁₆H₁₁NO₂ Cinchoninic acid, 1,2-dihydro-2-keto-3-phenyl-, 586¹.
 Pseudoisatin, 1- α -tolulyl-, 586¹.
 C₁₆H₁₁NO₂ Papaveralidine, and *salts*, 1989^a.
 C₁₆H₁₁N₂ α -Benzophenazine, 9-amino-, 1815^a.
 Imidazo[4,5-*f*]quinoline, 2(and 3)-phenyl-, 2691^a.
 C₁₆H₁₁N₂O₂ 12-Quino[2,3- β]quinoxalinedicarboxylic acid, 5,11-dihydro-, 586¹.
 C₁₆H₁₁N₂O₃ 8-Indeno[1,2- δ]triazolecarboxylic acid, 3,8-dihydro-8-hydroxy-3-phenyl-, *Na salt*, 742^a.
 1,4-Naphthoquinone, mono-*o*-nitrophenylhydrazine, 2133^a.
 1,2,5-Triazole-3-carboxylic acid, 4-benzoyl-1-phenyl-, 2268^a.
 C₁₆H₁₁N₂O₄ 1,2,3-Triazole-5-*o*-benzoic acid, 4-carboxy-1-phenyl-, 742^a.
 C₁₆H₁₁N₂O₅ 5-Quinolinesulfonic acid, 8-hydroxy-7-(*p*-nitrobenzamido)-, 1461^a.
 C₁₆H₁₁N₂S₃ 3,4-Phenanthra-7-thiomethyl-1,2,5,6-heptathiotriazine, 3199^a.
 C₁₆H₁₁N₂O₃ 1-Naphthalenediazosulfonic acid, (*p*-nitrophenylazo)-, *Na salt*, 380^a.
 C₁₆H₁₁ 2,1-Indenoidene, 5,10-dihydro-, 84².
 C₁₆H₁₁Ag₂CuO₄ Silver cuprimandate, 3168^a.
 C₁₆H₁₁BrNO₃ Carbostyryl, 3-(*p*-bromophenylsulfonyl)-8-methoxy-, 1122^a.
 C₁₆H₁₁BrN₂ 1-Naphthylamine, (bromophenylazo)-, 380^a; and *salts*, 1114².
 C₁₆H₁₁Br₂ Compds., m. 92-5° and 114°, from 1,4-diphenyl-2-butene-1,4-diol and HBr, 59^a.
 C₁₆H₁₁Br₂CINO₂ Diacetanilide, 2-bromo-4-(*p*-bromophenyl)-6-chloro-, 2689^a.
 C₁₆H₁₁Br₂N₂O₄ Diacetanilide, 2,6(?) dibromo-4-(*p*-nitrophenyl)-, 1109^a.
 C₁₆H₁₁Br₂N₂O₄ Succinic acid, diketo-, *p*-bromophenylosazone, 2899^a.
 C₁₆H₁₁Br₂O₂ 2(1)-Benzofuranone, 1-bromo-1-(α -bromobenzyl)-4-methyl-, 1084^a.
 1,4-Butanedione, 2,3-dibromo-1,4-diphenyl-, 82^a.
 C₁₆H₁₁Br₂N₂O₂ 1-(2,3,6-Tribromo-4,5-dihydroxyphenyl)pyridinium bromide, pyridine salt, 1640².
 C₁₆H₁₁CIN Acenaphthopyridine, 9-chloro-7-methyl-, 910^a.
 C₁₆H₁₁CINO₃ Quinoline, 2-chloro-8-methoxy-3-(phenylsulfonyl)-, 1122¹.
 C₁₆H₁₁CINO₃ Carbostyryl, 3-(*p*-chlorophenylsulfonyl)-8-methoxy-, 1123^a.
 C₁₆H₁₁CINO₃ 2-Naphthol-3(or 6)-sulfonyl chloride, 6(or 3)-(phenylsulfonyl)-, 3605^a.
 C₁₆H₁₁CIN₂ 1-Naphthylamine, (chlorophenylazo)-, 380^a; and *salts*, 1113^a.
 C₁₆H₁₁Cl₂ Anthracene, 1,5-dichloro-9-ethyl-, 1260².
 C₁₆H₁₁Cl₂N₂O₂ 5-Benzimidazolol, 4-chloro-1-(*p*-chlorophenyl)-2-methyl-, acetate, 2691^a.
 5-Benzimidazolol, 4,6-dichloro-2-methyl-1-phenyl-, acetate, 2691¹.
 C₁₆H₁₁Cl₂N₂O₄ Succinic acid, diketo-, *p*-chlorophenylosazone, 2899^a.
 C₁₆H₁₁Cl₂O Ether, 1,5-dichloro-9-anthrylmethyl methyl, 1260^a.
 C₁₆H₁₁Cl₂O₂ 1,4-Butanedione, 2,3-dichloro-1,4-diphenyl-, 82^a.
 Butyric acid, α , β -dichloro- γ -hydroxy- γ , γ -diphenyl-, lactone, 3616¹.
 C₁₆H₁₁CuHg₂O₆ Mercury cuprimandate, 3168^a.
 C₁₆H₁₁CuNa₂O₆ Sodium cuprimandate, 3168^a.
 C₁₆H₁₁Cu₂O₆ Copper cuprimandate, 3168^a.
 C₁₆H₁₁Hg Naphthyl phenyl mercury, 233^a.
 C₁₆H₁₁INO₃ Cinchoninic acid, 1,2,3,4-tetrahydro-2-keto-3-phenyl-, 586¹.
 C₁₆H₁₁N₂O 1,4-Naphthoquinonediimine, 3-hydroxy-N¹-phenyl-, 241³.
 Quinoxalinedicarboxylic acid, 2697^a.
 C₁₆H₁₁N₂O₂ 1,4-Naphthoquinonimine, 2-hydroxy-N-phenyl-, oxime, 241¹.
 C₁₆H₁₁N₂O₃ Indole, 3,3'-sulfonylbis-, 1459¹.
 C₁₆H₁₁N₂O₃ Disulfisatide, 2472^a.
 C₁₆H₁₁N₂O₃ 5(4)-Pyrazolone, 3-(3,4-methylenedioxyphenyl)-1-phenyl-, 3356¹.
 C₁₆H₁₁N₂O₄ 1,3-Butadiene, 2,3-dinitro-1,4-diphenyl-, 223¹.
 C₁₆H₁₁N₂O₄ Naphthalene, addn. compd. with 2,4-dinitrophenol, 232^a.
 C₁₆H₁₁N₂O₄ Oxalohydroxamic acid, di-Bz deriv., 1098¹.
 C₁₆H₁₁N₂O₇ Cinnamic acid, methoxydinitro-phenyl-, and *salts*, 2675^a.
 C₁₆H₁₁N₂O₄ Hydracrylic acid, β -(4,5-methylenedioxy-2-nitrophenyl)- α -(*o*-nitrophenyl)-, and *Na salt*, 3608^a.
 C₁₆H₁₁N₂O₅ 2,2'-Tolandisulfonic acid, 4,4'-dinitro-, di-Me ester, 908^a.
 C₁₆H₁₁N₂S₂ *p*-Tolunitrile, α , α' -thiobis-, 3899¹.
 C₁₆H₁₁N₂S₂ *p*-Tolunitrile, α , α' -dithiobis-, 3899¹.
 C₁₆H₁₁N₂O Triazoloquinolin-7(6)-one, 6-methyl-phenyl-, 2690¹.
 C₁₆H₁₁N₂O₂ 1-Naphthylamine, (nitrophenylazo)-, 380^a.
 C₁₆H₁₁N₂O₃ Guaiacol, 3,4,6-trinitro-, quinoline salt, 377¹.

- C₁₆H₁₂N₆O₂S₂ 1,2,4-Triazole-5(4)-one, 3,3'-dithiobis[4-phenyl-, 2900^o.
- C₁₆H₁₂N₆O₂ Piperazine, 1,4-dipicryl-, 2681^o.
- C₁₆H₁₂O₂ 2(1) - Benzofuranone, 1 - benzal - 4 - methyl-, 1984^o.
- Δ²-1,4-Butenedione, 1,4-diphenyl-, 3615^o.
- C₁₆H₁₂N₂O₂ Atropic acid, β-benzoyl-, 583^o.
- Benzotetronic acid, 3-benzyl-, 3192^o.
- Coumarin, 7-methoxy-3-phenyl-, 3193^o.
- Flavone, 5(and 6)-methoxy-, 1255^o.
- α-Tolualdehyde, α-(hydroxymethylene)-, benzoate, 2259^o.
- C₁₆H₁₂O₄ Flavanone, 3',4'-methylenedioxy-, 3194^o.
- Flavone, 7-hydroxy-4'-methoxy-, 93^o.
- 1,4 - Naphthalenediol, 2 - (2,4 - dihydroxy-phenyl)-, 2887^o.
- 1,3-Propanedione, 1-(3,4-methylenedioxy-phenyl)-3-phenyl-, 81^o.
- C₁₆H₁₂O₄ Acacetin, 93^o.
- Anthraquinone, 5-hydroxy-1,2-dimethoxy-, 910^o.
- 4,5-Dibenzofurandiol, diacetate, 2130^o.
- Flavone, 3,7-dihydroxy-4'-methoxy-, 93^o.
- Isoflavone, 5,7,4'-trihydroxy-2-methyl-, 246^o.
- 1,4-Naphthalenediol, 2-(3,4,5-trihydroxy-phenyl)-, 2887^o.
- Protocatechualdehyde, acetate, benzoate, 1107^o.
- C₁₆H₁₂O₆ Kampferide, 93^o.
- Luteolin, 3-methyl-, 2270^o.
- C₁₆H₁₂O₇ Isorhamnetin, 93^o.
- C₁₆H₁₂S Thiophene, diphenyl-, 3903^o.
- C₁₆H₁₂BrN₂O₂S Quinoline, 2-amino-3-(p-bromophenylsulfonyl)-8-methoxy-, and salts, 1122^o.
- C₁₆H₁₂BrN₂O₂S₂ 2,2'-Stilbenedisulfonic acid, α-bromo-4,4'-dinitro-, di-Me ester, 908^o.
- C₁₆H₁₂BrN₂O₂S Hydrazinesulfonic acid, β-[(p-bromophenylazo)-1-naphthyl]-, 380^o, and K salt, 1114^o.
- C₁₆H₁₂BrN₂O₂ 1,2,4 - Triazole, 1 - (p - bromophenyl)-3,5-dimethyl-, picrate, 3200^o.
- 1,2,4-Triazole, 1-(p-bromophenyl)-3,5-dimethyl-, picrate, 3620^o.
- C₁₆H₁₂BrO Furan, 3-bromo-2,5-dihydro-2,5-diphenyl-, 56^o.
- C₁₆H₁₂BrO₂ Chalcone, α-bromo-β-methoxy-, 575^o.
- C₁₆H₁₂BrO₂ Coumarilic acid, 2-bromo-1,2-dihydro-1-p-tolyl-, 911^o.
- C₁₆H₁₂BrO₂ Meconin, 2-(3-bromo-4-hydroxy-phenyl)-, 3350^o.
- C₁₆H₁₂Br₂N₂O₂ 1-Indanone, 2-bromo-2-(anilino-bromomethyl)-, 582^o.
- C₁₆H₁₂Br₂N₂O₂ Diacetanilide, 2,6-dibromo-4-phenyl-, 1109^o.
- C₁₆H₁₂Br₂ 2-Butene, 1,2,4-tribromo-1,4-diphenyl-(?), 56^o.
- C₁₆H₁₂ClN₂O₂S Quinoline, 2-amino-3-(p-chlorophenylsulfonyl)-8-methoxy-, and salts, 1122^o.
- C₁₆H₁₂ClN₂O₂ Veratrole, 4-(4-chloro-2-nitro-styryl)-2-nitro-, 580^o.
- C₁₆H₁₂ClN₄ Pyrimidine, dianilinochloro-, -HCl, 2271^o.
- C₁₆H₁₂ClN₄O₂S Hydrazinesulfonic acid, β-[(chlorophenylazo) - 1 - naphthyl]-, 380^o, and K salt, 1114^o.
- C₁₆H₁₂ClO₂ Chalcone, β-chloro-2'-hydroxy-5'-methyl-, 1255^o.
- C₁₆H₁₂ClO₂ Chalcone, β-chloro-2'-hydroxy-5'(and 6')-methoxy-, 1255^o.
- C₁₆H₁₂ClO₄ 3-Methylflavylium perchlorate, 2900^o.
- Trihydroxymethoxyflavylium chloride, 3195^o, 3620^o.
- C₁₆H₁₂CuNaO₂ Sodium hydrogen cuprimandelate, 3168^o.
- C₁₆H₁₂N₄ Triazoquinoline, phenyl-, methiodide, 2690^o.
- C₁₆H₁₂N₂ Acenaphthopyridine, 9-methyl-, and salts, 910^o.
- Quinoline, methylphenyl-, 2695^o; and chloroplatinate, 3622^o; and -HCl, 2695^o.
- , 2-p-tolyl-, 2695^o.
- C₁₆H₁₂NO Acenaphthopyridinol, 9-methyl-, and -HCl, 910^o.
- 1 - Indanone, 2 - (anilinomethylene)-, and -HCl, 582^o.
- Indole, 1-benzoyl-7-methyl-, 912^o.
- Ketone, methyl 3-phenyl-2-indyl, 1209^o.
- Quinoline, 2-p-anisyl-, and chloroplatinate, 3622^o.
- , 8-methoxy - 2 - phenyl, chloroplatinate, 3771^o.
- C₁₆H₁₂NO₂ β-Butenanilide, α-keto-γ-phenyl, 2902^o.
- β-Butenic acid, γ-phenyl α-phenylimino-, 2902^o.
- Carbostyryl, 4 - hydroxy - 1 - methyl-3-phenyl-(?), 1987^o.
- 1-Indanone, 2 - (phenylhydroxamino-methylene)-, 582^o.
- Phthalimide, N-phenethyl-, 78^o.
- 2,3-Pyrrolidinedione, 1,5-diphenyl-, 2882^o, 2902^o.
- 2,4-Quinolinediol, 3-benzyl-, 1987^o.
- , 8-methyl-3 phenyl-, 1987^o.
- 2-Quinolol, 8-methoxy-3-phenyl, 377^o.
- 4(1) - Quinolone, 2-hydroxy-1 methyl-3-phenyl-(?), 1987^o.
- C₁₆H₁₂NO₂S Acetic acid, diphenylthiocyano-, Me ester, 238^o.
- C₁₆H₁₂N₂ Benzamide, N-(3,4-methylene-dioxystryl)-, 1655^o.
- β-Butenic acid, α-(p-hydroxyphenylimino)-γ-phenyl-, 2902^o.
- Cinnamohydroxamic acid, Bz deriv, K salt, 3900^o.
- Fumarilic acid, phenyl ester, 2893^o.
- Phthalamic acid, N-styryl-, 1462^o, 1655^o.
- Phthalimide, phenetyl-, 1329^o.
- C₁₆H₁₂NO₂S Carbostyryl, 8-methoxy-3-(phenylsulfonyl)thio-, 1122^o.
- C₁₆H₁₂NO₂ Hippuric acid, o-benzoyl-, 508^o.
- Papaveroline, -H₂SO₄, 1980^o.
- C₁₆H₁₂NO₂S Carbostyryl, 8-methoxy-3-(phenylsulfonyl)-, 1121^o.
- C₁₆H₁₂NO₂S Benzoic acid, p-hydroxydithio-, Et ester, p-nitrobenzoate, 3190^o.
- C₁₆H₁₂N₂ 2,3 - Benzo - 6,7 - naphtho - 1,4,5-heptatriazine, 4,5-dihydro-, 2132^o.
- C₁₆H₁₂N₂O Phenol, p-(2-methyl-3-quinolyazo)-, 2474^o.
- Quinolol, 2-methylphenylazo-, 2474^o.
- C₁₆H₁₂N₂O Isoindazole, 1-acetyl-6-salicylamino-, 1120^o.
- 1,3,4 - Oxidazole, 2-(acetylmino)-2,3-dihydro-3,5-diphenyl-, 913^o.
- 4,5-Pyrazoledione, phenyl-p-tolyl-, 4-oxime, 1100^o.
- C₁₆H₁₂N₂O₂ Phthalide, 6-(benzalhydrazino)-5-methoxy-3-nitro-, 3358^o.
- C₁₆H₁₂N₂O₂ Pyridine, 2-(5-methyl-2-pyrryl)-, picrate, 460^o.

- C₁₆H₁₄N₃O₃** 1,2,4-Triazole, 3,5-dimethyl-1-(nitrophenyl)-, picrate, 32007.
- C₁₆H₁₄** 1,3-Butadiene, 1,3-diphenyl-, 1060⁶.
- C₁₆H₁₄AgN₃S₂** 1,4-s-Tetrazinedicarboxamide, 2-amino-5-anilino-N¹-phenyldithio(?), silver deriv., *AgNO₃ addn. compd.*, 2901⁵.
- 1,4-s-Tetrazinedicarboxamide, 2,5-dianilino(?), silver deriv., *AgNO₃ addn. compd.*, 2901⁵.
- 1,4-s-Tetrazinedicarboxanilide, 2,5-diaminodithio(?), silver deriv., *AgNO₃ addn. compd.*, 2901⁵.
- C₁₆H₁₄BeCl₂N₂** Addn. compd. from benzyl cyanide and BeCl₂, 1801⁸.
- Addn. compd. from *p*-toluonitrile and BeCl₂, 1801⁸.
- C₁₆H₁₄BrNO₃** Benzamide, *N*-(6-bromohomopiperonyl)-, 1270⁶.
- C₁₆H₁₄Br₂** Ethylene, 1,1-dibromo-2,2-ditolyl-, 234⁷.
- C₁₆H₁₄Br₂N₂O₁₀S₂** α, α' -Bi-*o*-toluenesulfonic acid, α, α' -dibromo-5,5'-dinitro-, di-Me ester, 908⁷.
- C₁₆H₁₄Br₂O** Propiophenone, α, β -dibromo-4-methyl- β -phenyl, 308¹.
- C₁₆H₁₄Br₂O₂** Anisole, (dibromovinylidene)bis-, 234⁷.
- C₁₆H₁₄ClNO₄** Veratrole, 4-(4-chloro-2-nitrostyryl)-, 580⁷.
- C₁₆H₁₄ClNO₃S** Naphtholsulfonic acid, chloro-aniline salt, 1646⁶, 3361².
- C₁₆H₁₄ClN₂O** Benzimidazole, 5-acetamido-4 (and 6) - chloro-2-methyl-1-phenyl-, 2691¹.
- Benzimidazole, 5-acetamido-4-chloro-1-*p*-tolyl-, 2691¹.
- C₁₆H₁₄ClN₂O₂** 1,2,3-Benzotriazol-5-ol, 6-chloro-4,7-dimethyl-1-phenyl-, acetate, 2690¹.
- C₁₆H₁₄Cl₂N₂O₁₀S₂** α, α' -Bi-*o*-toluenesulfonic acid, α, α' -dichloro-5,5'-dinitro-, di-Me ester, 908⁷.
- C₁₆H₁₄Cl₂O** 9-Anthrol, 1,5-dichloro-9-ethyl-9,10-dihydro-, 1250⁶.
- C₁₆H₁₄Cl₂O₂Zr** Compd. from ZrCl₄ and methyl salicylate, 1069⁶.
- C₁₆H₁₄Cl₃N₂O₄** Acetic acid, trichloro-, benzidine salt, 1630².
- C₁₆H₁₄Cl₃O₂Ti₂** Compd. from Me salicylate and TiCl₄, 739⁶.
- C₁₆H₁₄CuO₈** Shikonin, copper deriv., 2904⁹.
- C₁₆H₁₄Fe₂N₂O₁₀ + 2H₂O**, 2232².
- C₁₆H₁₄HgO₃S** Thiophene, 2,4-diphenyl-, acetoxymmercuri deriv., 3903⁸.
- C₁₆H₁₄N₂** Pyrazine, dihydridiphenyl-, *SnCl₄ addn. compds.*, 3902³.
- C₁₆H₁₄N₂O** 1-Indanone, 2-(anilinomethylene)-, oxime, and -HCl, 582⁹.
- 2-Naphthol, amino(*o*-aminophenyl)-, and -HCl, 1651^{2,4}.
- , 1-amino-4-anilino-, 241², 1124⁴.
- 5-Pyrazolone, 4-benzyl-1-phenyl-, 906⁶.
- Quinoline, 3-amino-2-*p*-anisyl-, 2474¹.
- , 2-amino-8-methoxy-3-phenyl-, and salts, 377².
- C₁₆H₁₄N₂O₂** 5-Benzimidazolol, 2-methyl-1-phenyl-, acetate, 2691¹.
- 1,2-Benzofurandione, 3,5-dimethyl-, phenylhydrazono-, 1116^{7,8}.
- β -Butenic acid, α -(β -aminophenylimino)- γ -phenyl-, 2902⁸.
- Carbazaldehyde, β -(β -benzoylvinyl)- β -phenyl-, 1450⁹.
- 1-Indanone, 2-(phenylhydroxamino-methylene)-, oxime, 582⁹.
- 3,6-Pyridazinedione, tetrahydro-diphenyl-, 1329¹.
- α -To'unitrile, α -(*p*-hydroxyanilino)-, acetate, 1794².
- C₁₆H₁₄N₂O₃** Cinchophen, 1,2,3,4-tetrahydro-1-nitroso-, 915¹.
- Cinnamaldehyde, *N*- and *O*-*p*-nitrobenzyl-oxime, 2257^{1,2,7}.
- Glyoxylohydroxamamillide, α -phenyl-, Ac deriv., 1099¹.
- 5-Indanamine, *N*-benzoyl-4-nitro-, 85⁹.
- C₁₆H₁₄N₂O₅S** 4-Quinazolinecarboxylic acid, 1,2,3,4-tetrahydro-4-hydroxy-3-phenyl-2-thioketo-, Me ester, 587⁴.
- Quinoline, 2-amino-8-methoxy-3-(phenylsulfonyl)-, and salts, 1121².
- C₁₆H₁₄N₂O₄** Oxindole, 3-(6-amino- α -hydroxy-piperonyl)-, -HCl, 3608⁸.
- Phenol, *o, o'*-azobis-, diacetate, 1972⁴.
- C₁₆H₁₄N₂O₃S** Cyclobutane, 1,3-bis(*m*-nitrophenylmercapto)-, 3191³.
- C₁₆H₁₄N₂O₂** Benzoic acid, *p*-(*m*-nitrobenzamido)-, Et ester, 1451⁵.
- Pyrogallol, 4-phenylazo-, diacetate, 3050⁴.
- C₁₆H₁₄N₂O₃S** Benzenesulfonic acid, *m*-nitro-, naphthylamine salt, 1103⁹.
- C₁₆H₁₄N₂O₄S** 2-Naphtholsulfonic acid, *m*-nitroaniline salt, 1646⁶.
- C₁₆H₁₄N₂O₇** Hydracrylic acid, α, β -bis(*o*-nitrophenyl)-, Me ester, 2260¹.
- Hydrocinnamic acid, β -methoxy-*o*-nitro- α -(*o*-nitrophenyl)-, 2260¹.
- C₁₆H₁₄N₂O₁₀S₂** 2,2'-Stilbenedisulfonic acid, 4,4'-dinitro-, di-Me ester, 908⁷.
- C₁₆H₁₄N₂O₁₁S₂** α, α' -Bi-*o*-toluenesulfonic acid, α -keto-5,5'-dinitro-, di-Me ester, 909².
- C₁₆H₁₄N₂S₂** 1,4,3-Isotriodiazine, 2-(methylmercapto)-4,5-diphenyl-, 391⁸.
- C₁₆H₁₄N₄O₂** Indole, 2-ethyl-3-(*p*-nitrophenylazo)-, 1263⁴.
- C₁₆H₁₄N₄O₄** Butanetetrone, 1,4-diphenyl-, tetraoxime, 1099³.
- C₁₆H₁₄N₄O₃S₂** Disulfide, bis(α -methylimino-4-nitro-*o*-tolyl)-, 2692².
- C₁₆H₁₄N₄O₆** *p, p'*-Biacetanilide, 2,3'-dinitro-, 1110².
- Glyoxylic acid, (2,4-dinitrophenyl)-, Et ester, phenylhydrazono-, 1257⁶.
- Indole, addn. compd. with trinitroxylenes, 73⁴.
- C₁₆H₁₄N₄O₇** Indoline, 7-methyl-, picrate, 912⁷.
- C₁₆H₁₄N₄O₈** 1(2)-Naphthalenone, 7-amino-3,4-dihydro-, picrate, 1123⁴.
- C₁₆H₁₄N₄O₉** Anthranilic acid, *N*- β -hydroxyethyl-*N*-methyl-, lactone, picrate, 2467⁹.
- Ether, bis(2,4-dinitro-3,5-xylyl)-, 230⁴.
- C₁₆H₁₄N₄O** 5-Indazolol, 2-methyl-4-(2-methyl-5-indazolylazo)-, 2693⁸.
- C₁₆H₁₄N₄O₈** Piperazine, 1,4-bis(2,4-dinitrophenyl)-, 2681⁸.
- C₁₆H₁₄N₄O₃** Shikonin, sodium deriv., 2904⁹.
- C₁₆H₁₄O** Benzophenone, *o*-isopropenyl-, 1648¹.
- Chalcone, methyl-, 76⁸, 77², 397⁸.
- C₁₆H₁₄O₂** 1,3-Disulfide, 2-benzoyl-4,5-dihydro-2-phenyl-, 72⁹.
- C₁₆H₁₄O₃** *p, p'*-Biacetophenone, 2272⁹.
- Δ^2 -2-Butenone, 1-phenyl-4-salicyl-, 80⁶.
- 2-Butine-1,4-diol, 1,4-diphenyl-, 584¹.
- Chalcone, 2'-hydroxy-5'-methyl-, 1255².
- , methoxy-, 396⁸, 397⁸, 575⁹.
- Cinnamic acid, benzyl ester, 2430⁸.
- 9-Fluoreno!, 9-methyl-, acetate, 3902⁷.

- C₁₆H₁₄O₂S** Acetophenone, α, α' -thiobis-, 2885¹.
C₁₆H₁₄O₂S₂ Benzoic acid, *p*-hydroxydithio-, Et ester, benzoate, 3196².
C₁₆H₁₄O₂ Chalcone, 2'-hydroxy-5'-(and 6')-methoxy-, 1255^{1,2}.
 Coumarilic acid, 1,2-dihydro-1-phenyl-, Me ester, 911³.
 —, 1,2-dihydro-1-*p*-tolyl-, 911⁴.
 Guaiacol, 4-vinyl-, benzoate, 3050¹.
 1,3-Propanedione, 1-anisyl-3-phenyl-, 81^{2,4}.
 9-Xanthencarboxylic acid, ethyl-, 3904⁵.
 —, methyl-, Me ester, 3904⁵.
C₁₆H₁₄O₄ Propionic acid, β -benzoyl- β -hydroxy- α -phenyl-, 583⁷.
 Sinomenol, 1654¹, 1656¹.
C₁₆H₁₄O₂S₂ Acetic acid, *p, p'*-dithiobis[phenylmercapto-, 1096².
C₁₆H₁₄O₂ Benzoic anhydride, *o, o'*-dimethoxy-, 3347¹.
 Meconin, 2-salicyl-, 3356⁹.
C₁₆H₁₄O₂Te Phenoxtellurine, 10,10-diacetate, 1104².
C₁₆H₁₄O₆ 2(1) - Benzofuranone, 3,5-dihydroxy-1-*p*-hydroxybenzyl - 4 - methoxy-(?), 3050⁹.
C₁₆H₁₄AsO₂ Compd. from arsonoacetic acid, pyrocatechol, and acetic acid, 905⁴.
C₁₆H₁₄Br₂N₂O₄ Compd., m. about 215°, from piperazine and 4,4'-dibromo-3,3'-dinitrohiphenyl, 2681⁴.
 Piperazine, 1-[4-(4-bromo-2-nitrophenyl)-2-nitrophenyl]-, 379⁷.
C₁₆H₁₄Br₂O₂ Anisole, (bromovinylidene)bis-, 234².
C₁₆H₁₄Br₂ Ethane, 1-tribromo-2,2-ditolyl-, 234¹.
C₁₆H₁₄Br₃O₂ Anisole, (β -tribromoethylidene)-bis-, 234¹.
C₁₆H₁₄ClN₂ Acetamidine, *N*-(α chlorovinyl)-*N, N'*-diphenyl-, 1445⁹.
C₁₆H₁₄ClN₂O₄ Piperazine, 1-[4-(4-chloro-2-nitrophenyl)-2-nitrophenyl]-, 379⁷.
C₁₆H₁₄N Allylamine, *N*-diphenylmethylene-, 3901⁴.
 Indole, 3-ethyl-2-phenyl-, 1263¹.
C₁₆H₁₄NO β -Butenamide, β -phenyl-, 228⁹.
 Indoline, 1-benzoyl-7-methyl-, 912⁷.
C₁₆H₁₄NO₂ Acenaphthene, 3-(α -acetylacetamido)-, 910⁴.
 Benzamide, *N*-(α -acetylbenzyl)-, 75⁷.
 —, *N*-(*p*-methoxystyryl)-, 1655⁴.
 2(1) - Benzofuranone, 1-anilino-1,4-dimethyl-, 911³.
 Cinchophen, 1,2,3,4-tetrahydro-, 914⁴.
 Diacetanilide, 4-phenyl-, 2681¹.
 Indole, 2-(3,4-dimethoxyphenyl)-, and -HCl, 1262⁷.
C₁₆H₁₄NO₂ (See also *Hypnactin*.)
 Acetanilide, *p* - (*p* - hydroxyphenyl)-, acetate, 238¹, 403¹.
 Glycine, diphenylacetyl-, 947⁴.
 α -Toluc acid, 2-hydroxy-4,6-dimethyl- α -phenylimino-, 1116⁹.
C₁₆H₁₄NO₄ Ketone, 2-hydroxy-1-naphthyl methyl, oxime, diacetate, 3364¹.
 Propionic acid, β -benzoyl- β -hydroxy- α -phenyl-, oxime, 583⁷.
C₁₆H₁₄NO₂S Naphtholsulfonic acid, aniline salt, 1646¹, 3861¹.
C₁₆H₁₄NO₂S₂ 2-Naphtholdisulfonic acid, aniline acid salt, 1646¹.
C₁₆H₁₄N₂O Benzimidazole, 5-acetamido-1-*p*-tolyl-, 2691¹.
 1,4 - Imidazopyridin - 2(3) - one, 3-(*p*-dimethylaminobenzal)-, and -HCl, 1265¹.
C₁₆H₁₄N₂O₂ Carbazole, 2,7-diacetamido-, 3199¹.
C₁₆H₁₄N₂O₂ 2,3-Butanedione, 1-phenyl-, 2-m-nitrophenylhydrazone, 1269².
 Carbanilide, *o*-formyl-, oxime, Ac deriv., 1119⁴.
C₁₆H₁₄N₂O₂ 2-Naphthylamine, *N*-(2,4-dinitrophenyl)-1,2,3,4-tetrahydro-, 4051¹.
 Piperonal, β -ethyl - β - (*p* - nitrophenyl)-hydrazone, 1251⁴.
C₁₆H₁₄N₂O₂ Glyoxylic acid, salicyl-, Et ester, *p*-nitrophenylhydrazone, 1117¹.
 3 - Isoindazolecarboxylic acid, 1-(*o*-nitrobenzoyl)-, methyl ester, 2900².
C₁₆H₁₄N₂O₂ Carbamic acid, bis(*p*-nitrobenzyl)-, Me ester, 1978¹.
C₁₆H₁₄N₂S 1,4,3 - Isothiodiazine, 2,3-dihydro-5 - methyl - 3 - phenyl - 2 - phenylimino-, 3200⁴.
C₁₆H₁₄N₂O₂ 2,1,3-Benzotriazole, 4,5-diacetamido-2-phenyl-, 2689⁴.
C₁₆H₁₄N₂O₂ 1,2,4-Triazole, 1-(aminophenyl)-3,5-dimethyl-, picrate, 3200⁷, 3620⁷.
C₁₆H₁₄Br₂ClNO Pseudocumenol, *r, r'*-3,3-dibromo- α, α' -(6-chloro-*o*-oluno)-, 903¹.
C₁₆H₁₄Br₂N₂S₂ Benzotriazole, 1-amino-5-methyl-, tribromide, 2688⁴.
C₁₆H₁₄ClNO Benzamide, *N*-[*p*-(chloromethyl)-phenethyl], 546².
C₁₆H₁₄ClNO₂ *o*-Toluidine, 5-chloro- α -veratral-, 580⁴.
C₁₆H₁₄Cl₂N₂O₂ Acetic acid, dichloro-, benzidine salt, 1630².
C₁₆H₁₄Cl₂O₂Zr Addn. compd. of ZrCl₄ and C₂H₅COCH₃, 1069².
C₁₆H₁₄N₂ Pyridazine, 1,2,3,6-tetrahydro-3,6-diphenyl-, 1124².
C₁₆H₁₄N₂O *p*-Acetotoluide, α -*p*-tolylimino-, 1254⁴.
 2,3-Butanedione, 1-phenyl-, 2-phenylhydrazone, 1269².
 Δ^2 -2-Butenone, 4 - (*p* - hydroxyphenyl)-, phenylhydrazone, 1449².
C₁₆H₁₄N₂O₂S 2(1)-Quinazolone, 4-ethoxy-3,4-dihydro-3-phenyl-2-thio-, 587⁴.
C₁₆H₁₄N₂O₂S Carbonic acid, dithiol-, Me phenacyl ester, phenylhydrazone, 391¹.
C₁₆H₁₄N₂O₂ Acetophenone, *p*-methyl-, oxime, carbanilate, 1628².
 Acetophenone, oxime, *o*(and *p*)-methylcarbanilates, 1628².
p-Anisidine, *N, N'*-acetylenebis-, 1973¹.
 Benzimidazole, 5 - ethoxy - 2 - (phenoxy-methyl)-, P 158¹.
 Glyoxime, diphenyl-, di-Me deriv., and -HCl, 1098².
o - Phenylenediamine, *N, N'*-diacetyl-4-phenyl-, 237¹.
 2(1)-Quinazolone, 4-ethoxy-3,4-dihydro-3-phenyl-, 587⁴.
C₁₆H₁₄N₂O₂S₂ Acetanilide, *o, o'*-dithiobis-, 234⁴.
C₁₆H₁₄N₂O₂ Anthranilic acid, *N*-(*p*-acetamidophenyl)-, Me ester, 232¹.
 Benzoic acid, 5-acetamido-2-anilino-, Me ester, 232⁴.
 —, *p* - (*m* - aminobenzamido)-, Et ester, and -HCl, 1451⁴.
 Glyoxylic acid, (6 - hydroxy - 2,4 - xyl)-, phenylhydrazone, 1116⁹.
C₁₆H₁₄N₂O₂ *p*-Toluidine, 3-nitro- α -veratral-, and -HCl, 580⁴.
C₁₆H₁₄N₂O₂S₂ Acetanilide, *o, o'*(and *m, m'*)-dithiobis-, S-dioxide, 234⁴.

- Benzisosulfonazole, 1-ethyl-1,2-dihydro-2-o-tolylsulfonylimino-, 2888².
- Carbanilic acid, *p,p'*-dithiobis-, di-Me ester, 234⁴.
- C₁₀H₁₁N₃O₂ Hydracrylic acid, β -(2-amino-4,5-methylenedioxyphenyl)- α -(*o*-amino-phenyl)-, 3608⁶.
- C₁₀H₁₁N₃O₂S 2-Propanone, 1-(*o*-nitrophenyl)-, oxime, *p*-toluenesulfonyl deriv., 75⁵.
- Sulfanilic acid, *N*-acetyl-, *p*-acetamidophenyl ester, 234⁴.
- C₁₀H₁₁N₃O₂ Benzanilide, 3,4,5-trimethoxy-2-nitro-, 911¹.
- C₁₀H₁₁N₃O₂S *m*-Toluenesulfono-*p*-toluide, 6-hydroxy-5-nitro-, acetate, 3897⁴.
- C₁₀H₁₁N₃O₂S Acetanilide, *p,p'*-disulfonylbis-, 234⁴.
- Carbanilic acid, *p,p'*-dithiobis-, di Me ester, S-dioxide, 234⁴.
- C₁₀H₁₁N₃O₂V Pyridine, vanadylmalonate, 2230⁸.
- C₁₀H₁₁N₃O₂V Pyridone, vanadylmalonate, 2230⁸.
- C₁₀H₁₁N₄O Acetophenone, carbonylhydrazone with BzH, 1249¹.
- 1,2,3-Benzotriazole, 5-acetamido-4,7-dimethyl-phenyl-, 2690².
- C₁₀H₁₁N₄O₂ Ethylazirine, 3-bis-(*p*-anisylazo), 1972².
- Glyoxylic acid, *p*-tolylazo-, *p*-tolylhydrazone, 1654².
- C₁₀H₁₁N₄O₂ Isoquinoline, 1,2,3,4-tetrahydro-7-methyl-, picrate, 1461¹.
- C₁₀H₁₁N₄O₂ Allylhydroxymethylphenylammonium picrate, 65⁶.
- Ketone, ethyl 6-ethyl-3-pyridyl-, picrate 387¹.
- C₁₀H₁₁N₄O₂ Anthranilic acid, *N*- β -hydroxyethyl-, Me ester, picrate, 2467².
- Benzoic acid, *p*-(β -hydroxyethylamino)-, Me ester, picrate, 2467².
- C₁₀H₁₁N₄S 1,3,4-Triazole - 2-mercaptan, 5-*p*-toluino-1-*p*-tolyl-, 2900⁶.
- C₁₀H₁₁N₄S 1,4-*s*-Tetrazinedicarboxamide, 2-amino-5-anilino-*N*¹-phenyldithio-(?), 2901⁶.
- 1,4-*s*-Tetrazinedicarboxanilide, 2,5-diaminodithio-(?), 2901⁶.
- 1,4-*s*-Tetrazinedicarboxamide, 2,5-dianilindithio-(?), 2901⁶.
- C₁₀H₁₁O Acetaldehyde, di-*p*-tolyl-, 380².
- Acetophenone, *p*-methyl- α -*p*-tolyl-, 380².
- Fluorene, 9-ethoxy-9-methyl-, 3902².
- C₁₀H₁₁O₂ Benzyl alcohol, α -ethyl-, benzoate, 2938⁴.
- 1-Isobenzofuranol, 1,2-dihydro-2,2-dimethyl-1-phenyl-, 1648¹.
- Phenethyl alcohol, benzoate, 2938⁴.
- Phenetole, vinylidenebis-, 234².
- 1-Propanol, 3-phenyl-, benzoate, 2938⁴.
- C₁₀H₁₁O₂ Benzophenone, trimethoxy-, 81².
- γ,ϵ -Heptadienic acid, α -acetyl- β -keto- γ -phenyl-, Me ester, 2468².
- C₁₀H₁₁O₂ Naphthalenediol, ethoxy-, diacetate, 83².
- Shikonin, 2904³.
- o*-Veratric acid, 6-*p*-hydroxybenzyl-, 3357².
- C₁₀H₁₁O₂ Benzophenone, 2',4'-dihydroxy-3,4,5-trimethoxy-, 1981¹.
- C₁₀H₁₁O₂ Δ^1 -Cyclohexene - Δ^1,β -propionic acid, α,δ -diacetyl-5-carboxy-2,6-diketo-, di-Me ester, 1266⁸.
- C₁₀H₁₁Se₂ Acetophenone, seleno-, dimer, 1963³.
- C₁₀H₁₁AsN₂O₂ Arsanilic acid, *N*-(*N*-anisoylglycyl)-, 71¹.
- C₁₀H₁₁BrO₂ Anisole, (β -bromoethylidene)bis-, 234².
- C₁₀H₁₁BrNO₂ Pseudocumenol, 3,6-dibromo- α' -[*o*(and *p*)-methoxyanilino]-, 902².
- C₁₀H₁₁N Acenaphthopyridine, 7,8,9,10-tetrahydromethyl-, and salts, 910⁸.
- C₁₀H₁₁NO Acetamide, *N,N*-dibenzyl-, 73¹.
- Quinoline, 1,2,3,4-tetrahydro-8-methoxyphenyl-, and -HCl, 377^{1,2}.
- C₁₀H₁₁NO₂ Carbamic acid, dibenzyl-, Me ester, 1978¹.
- Carbanilic acid, benzyl-, ethyl ester, 2430⁶.
- Cinchophen, 1',2',3',4',5',6'-hexahydro-, 914².
- C₁₀H₁₁NO₂S Isoquinoline, 1,2,3,4-tetrahydro-7-methyl-2-(phenylsulfonyl)-, 1460⁶.
- C₁₀H₁₁NO₂ Anisaldehyde, *N*-*o*-methoxybenzyl-oxime, 2257⁴.
- Pyrolocarboxylic acid, benzoyldimethyl-, Et ester, 382².
- C₁₀H₁₁NO₂S 2-Propanone, 1-phenyl-, oxime, *p*-toluenesulfonyl deriv., 75⁵.
- C₁₀H₁₁NO₂ Benzophenone, trimethoxy-, oxime, 81².
- C₁₀H₁₁NO₂ Shikonin, oxime, 2905¹.
- C₁₀H₁₁NO₂S Cinnamic acid, *o*(and *m*)-sulfo-, acid toluidine salt, 577^{2,3}.
- C₁₀H₁₁NO₂S Cinnamic acid, *o*(and *m*)-sulfo-, acid *p*-anisidine salt, 577^{2,3}.
- C₁₀H₁₁N₂O Acetaldehyde, phenyl-*p*-tolyl-, semicarbazone, 3051².
- C₁₀H₁₁N₂O₂ Acetophenone, 2,5-dimethyl-, *p*-nitrophenylhydrazone, 3611⁸.
- C₁₀H₁₁N₂O₂ 2,5-Acetoxylyde, 6-anilino-3-nitro-, 2690².
- Anisaldehyde, β -ethyl- β -(*p*-nitrophenyl)-hydrazone, 1251⁴.
- C₁₀H₁₁N₂O₂ Dibenzylamine, α,α' -bis(nitromethyl)-, 2253².
- Vanillin, β -ethyl- β -(*p*-nitrophenyl)hydrazone, 1251⁴.
- C₁₀H₁₁N₂O₂ Asaronaldehyde, *p*-nitrophenylhydrazone, 1974⁵.
- C₁₀H₁₁N₂S Thionine, diethyl-, 1283⁶.
- C₁₀H₁₁N₂O₆ Benzidine, *N,N,N',N'*-tetramethyltrinitro-(?), 238³.
- C₁₀H₁₁N₂Q₂ Acetanilide, *N*-methyl- α -methylamino-, picrate, 3355¹.
- C₁₀H₁₁N₂O₂ Phenethylamine, *N,N*-dimethyl-*o*(and *p*)-nitro-, picrate, 1250⁶.
- Trimethyl(nitrobenzyl)ammonium picrate, 1250⁶.
- C₁₀H₁₁S Methane, phenyl(*p*-propylphenyl)-, 82².
- C₁₀H₁₁Br₂N Bis(*p*-iodobenzyl)dimethylammonium bromide, 541¹.
- C₁₀H₁₁BrP Allyltrimethylphenylphosphonium bromide, 66².
- C₁₀H₁₁BrN₂S β -Naphthothiazole, 2-(amylamino)-, tetrabromide, -HBr, 584².
- C₁₀H₁₁BrN₂S β -Naphthothiazole, 2-isomethylamino-, hexabromide, -HBr, 584².
- C₁₀H₁₁ClH₂N₂NaO₂ See *Novasurol*.
- C₁₀H₁₁ClNO₂ Camphorimide, *N*-(chlorophenyl)-, 3613⁴.
- C₁₀H₁₁ClN₂O₂ Dimethylbis(*p*-nitrobenzyl)-ammonium chloride, 3614².
- C₁₀H₁₁ClN₂S See *Methylene blue*.
- C₁₀H₁₁IN Ethylamine, *N*-diphenylmethylene-, methiodide, 3901¹.
- C₁₀H₁₁N Δ^1 -1,4-Butenediamine, 1,4-diphenyl-, 1124².
- Quinazoline, 5,6,7,8-tetrahydro-4,7(and 4,8)-dimethyl-2-phenyl-, 3198^{2,7}.

- , 5,6,7,8 - tetrahydro - 4 - methyl-2-*p*-tolyl-, 3198^a.
- C₁₆H₁₈N₂O Acetanilide, 2-dimethylamino-5-phenyl-, 238¹.
Cumohydroxamanilide, 1107¹.
4 - Quinazolinol, 5,6,7,8-tetrahydro-7-(and 8)-methyl-2-*p*-tolyl-, 3198⁷.
- C₁₆H₁₈N₂O₂ Anthranilic acid, *N*-(*p*-dimethylaminophenyl)-, Me ester, 2250⁴.
- C₁₆H₁₈N₂O₃ Phenetole, *p,p'*-azoxybis-, 3538³.
Valeric acid, β(and γ)-(1-naphthylcarbamido)-, 578⁹.
- C₁₆H₁₈N₂O₄ Anisole, 2-nitromethyl-(?), dimer, 2257⁹.
- C₁₆H₁₈N₂O₅ Glutamic acid, *N*-(*α*-acetamidocinnamyl)-, 61².
3-Indolepropionic acid, 2-carboxy-5-nitro-, di-Et ester, 90⁴.
- C₁₆H₁₈N₂S β-Naphthothiazole, 2-(amylamino)-, 584³.
β-Naphthothiazole, 2-isoamylamino-, 584³.
- C₁₆H₁₈N₂O Acetone, 4-diphenylaminosemicarbazone, 69¹.
Acetophenone, 4 - (*N* - methylanilino)-semicarbazone, 69¹.
2-Propanone, 1-phenyl-, 4-anilinosemicarbazone, 68⁹.
- C₁₆H₁₈N₂O₂ 2,3-Butanediamine, *N,N'*-bis-(*p*-nitrosophenyl)-, and di-HCl, 1810¹.
2,3 - Butanediamine, *N,N'*-dinitroso-*N,N'*-diphenyl-, 1810².
Glyoxal, *p*-anisylsazone, 1973².
- C₁₆H₁₈N₂O₄ Benzidine, *N,N,N',N'*-tetramethyldinitro-, 238².
- C₁₆H₁₈N₂O₆ 2-Naphthylamine, 1,6,8-trinitro-*N,N*-dipropyl-, 404⁷.
- C₁₆H₁₈N₂O₇ Aniline, *N*-methyl *N*-propyl-, picrate, 65⁴.
Benzyltrimethylammonium picrate, 1250⁶.
Propylamine, γ-*p*-tolyl-, picrate, 1461¹.
- C₁₆H₁₈N₂O₈ Hydroxymethylphenylpropylammonium picrate, 65⁷.
- C₁₆H₁₈N₂O₉ Pyrocatechol, 4 (β-dimethylaminoethyl)-, picrate, 2069⁴.
- C₁₆H₁₈N₂O₁₀ Pseudoscorpine, acetate, picrate, 3365⁵.
- C₁₆H₁₈N₂O₁₄ 2,3-Butanediamine, ¹ picrate, 2120¹.
- C₁₆H₁₈O Ether, bis(methylbenzyl), 1638³, 3603⁵.
Naphthol, cyclohexyl-, 1114⁴.
3,5-Xylyl ether, 230⁴.
- C₁₆H₁₈O₂ Bi[3,4-xylene], 1452⁶.
- C₁₆H₁₈O₂ Compd., sinters 153°, decomps. 162-3°, from 1-cyclohexyl-2-naphthol, 1114⁹.
- C₁₆H₁₈O₄ 2,7-Octanedione, 4,5-difuryl-, 1116⁵.
- C₁₆H₁₈O₅ Malonic acid, α-(hydroxypropylmethyl)benzyl-, lactone, 894³.
Malonic acid, (α-2-ketocyclohexylbenzyl)-, 231⁴.
- C₁₆H₁₈O₁₀ Glialdehyde, tris(ethyl carbonate), 2886⁴.
- C₁₆H₁₈IN₂ *p*-Toluidine, *N,N*-dimethyl *α*-phenylimino-, methiodide, 403⁴.
- C₁₆H₁₈NO Camphor, 3-phenylimino-, 2266².
1-Propanol, 1 - (α - aminobenzyl)-1-phenyl-, and -HCl, 1978¹.
- C₁₆H₁₈NO₂ Compd., m. 144°, from *N*-benzylcyclohexylamine, 914⁹.
1 - Naphthalenecarboxylic acid, Am ester, 3888³; β,β-dimethylpropyl ester, 3888³; α-ethylpropyl ester, 3888³; isoamyl ester, 3888³; α-methylbutyl ester, 1962¹, 3888³.
- C₁₆H₁₈NO₂S α-Toluenesulfonanilide, *N*-propyl-, 99⁴.
- C₁₆H₁₈NO₄ β-Butenic acid, α-(amylimino)-γ - (3,4 - methylenedioxyphenyl)-, 2882⁹.
3-Indolepropionic acid, 2-carboxy-, di-Et ester, 90⁴, 583³, 1263³.
Licorine, dihydro-, and salts, 3622⁹.
Malonic acid, (3-indylmethyl)-, di-Et ester, 583³.
Sekisanine, and salts, 3622⁹.
- C₁₆H₁₈NO₅S Acetamide, *N*-benzyl-, *p*-toluenesulfonate, 75⁷.
- C₁₆H₁₈NO₆ 3 - Quinaldicarboxylic acid, 4-hydroxy - 6,7,8 - trimethoxy-, Et ester, 912².
- C₁₆H₁₈NO₉ Acetoacetic acid, α (3,4,5-trimethoxy-2-nitrobenzoyl)-, Et ester, 911⁹.
- C₁₆H₁₈N₂O Semicarbazide, 1-ethyl 4-phenyl-1-*o*-tolyl-, 2899⁸.
- C₁₆H₁₈N₂O₈ Methylene blue, 1735².
- C₁₆H₁₈N₂O₂ Benzidine, *N,N,N',N'*-tetramethyl-3-nitro-, 238².
Benzoic acid, 5-amino-2-(*p*-dimethylaminonilino)-, Me ester, 2259⁶.
2,5 - Piperazindione, 1,4 - dimethyl-, 2-naphthylamine addn. compd., 1797².
Quinoline, 2,4 - dimethyl - 8 - nitro - 7-piperidyl-, 3621⁷.
Spiro[naphthalene - piperidine] 3',5' dinitrile, octahydro-2',6'-diketo-, 1113⁵.
- C₁₆H₁₈N₂O₇ Bornecol, picrate, 379¹.
- C₁₆H₁₈N₂O₁₀ Papaveralolone, picrolonate, 1980⁸.
- C₁₆H₁₈BrP Dimethylphenethylphenylphosphonium bromide, 66⁵.
Methyldiphenylpropylphosphonium bromide, 66².
- C₁₆H₁₈ClN Dimethyl(α - methylbenzyl)phenylammonium chloride, 2673³.
- C₁₆H₁₈ClNO Camphoraulic acid, 2', (3' and 4')-chloro-, 3613⁴.
- C₁₆H₂₀Ge₂N₂O₃ Germanoformic anhydride, bis(dimethylaminophenyl)-, 3897².
- C₁₆H₂₀IP Benzylethylmethylphenylphosphonium iodide, 66⁵.
- C₁₆H₂₀NO₂ + 3H₂O See *Kukoline*.
- C₁₆H₂₀N₂O₂ 2,3-Butanediamine, *N,N'*-diphenyl-, and salts, 1810¹.
- Hydrazine, α-cyclohexyl - α - 2 - naphthyl-, and -HCl, 2672².
- C₁₆H₂₀N₂O Compd., m. 179°, from 2 benzyl-oxo - 2 - methyl - 5 - phenyl - 3(2)-pyrrolone and piperidine, 1106⁴.
- C₁₆H₂₀N₂O₂ Carbazole, acetamidocetylhexahydro-, 2898².
- 3,5 - Pyrazoledione, allyldiethylphenyl-, 1329¹.
3 - Pyrrolecarboxylic acid, 5-[(3,5-dimethylisopropylidene)methyl] - 2,4 - dimethyl-, Et ester, 2701⁴.
- C₁₆H₂₀N₂O₃ Cinchophen, 1,2,3,4,1',2',3',4',-5',6'-decahydro-1-nitroso-, 915¹.
Malonamide, (α - 2 - ketocyclohexylbenzyl)-, 231⁴.
- C₁₆H₂₀N₂O₅ Benzenesulfonamide, *N,N'*-1,4-butylenebis-, 1964⁴.
- C₁₆H₂₀N₂O₅ Glutamic acid, *N*-(*N*-acetyl-β-phenylalanyl)-, 61².
- Nipecotic acid, 1-β-hydroxyethyl-, Me ester, *p*-nitrobenzoate, -HCl, 1977¹.
- C₁₆H₂₀N₂S Urea, α-amyl-β-1-naphthylthio-, 584⁹.
Urea, α-isoamyl - β - 1 - naphthylthio-, 584⁹.

- $C_{11}H_{20}N_4O_2$ Carbamic acid, mesoxalylbis-, di-Et ester, *p*-tolylhydrazone, 1654¹.
- $C_{11}H_{20}N_4O_4$ 4 - Cinnolinebiscarbamic acid, 1,2-dicarboxy - 1,2,3,4 - tetrahydro-, tetra-Me ester, 1124¹.
- $C_{11}H_{20}O$ Cyclohexanone, γ -benzal-2-ethyl-2-methyl-, 2465¹.
- $C_{11}H_{20}O_2$ Cyclohexanepropionic acid, 2-keto- β -phenyl-, Me ester, 231⁴.
- $C_{11}H_{20}O_4$ Hydrocinnamic acid, β -(β , β -dihydroxy - *tert* - butyl) - α - methyl-, lactone, acetate, 3044⁸.
- Phthalic acid, mono(3,5-dimethylcyclohexyl) ester, 230⁸.
- $C_{11}H_{20}O_6$ Malonic acid, α -(α -formylisopropyl)-benzyl-, di-Me ester, 3043⁸.
- Malonic acid, α -pivalylmethylbenzyl-, and Ag salt, 894².
- $C_{11}H_{20}O_{10}$ Benzyl alcohol, 3,4,5-trihydroxy-, tris(ethyl carbonate), 2880⁸.
- $C_{11}H_{22}AsN_2O$ Arsinous acid, bis(dimethylamino-phenyl)-, 1973⁹.
- $C_{11}H_{22}BrN_2$ Isopyrrole, 2-[5 bromo-4(or 3)-ethyl - 3(or 4) - methyl - 2 - pyrrol-methylene] - 3(or 4) - ethyl - 4(or 3)-methyl-, 103⁷.
- $C_{11}H_{21}NO$ Quinoline, 1-benzoyldecahydro-, 2903^{3,4}.
- $C_{11}H_{21}NO_2$ β -Butenic acid, α (amylimino)- γ *p*-tolyl-, 2882⁸.
- Cinchophen, decahydro-, 914⁸.
- 2-Indanol, hexahydro-, carbanilate, 1112⁸, 1113¹.
- Nicotinic acid, bornyl ester, P 593².
- Picolinic acid, bornyl ester, P 593².
- $C_{11}H_{21}NO_3$ (See also *Homatropine*.)
- Cyclohexanecetic acid, 2 (phenylcarbamyl methyl), 1112².
- $C_{11}H_{21}NO_4$ Homatropine, *N*-oxide, and -HBr, 384⁵.
- $C_{11}H_{21}NO_5$ Malonic acid, [(4-carboxy-5-methyl-2-pyrrol)methylene]-, tri-Et ester, 381².
- Malonic acid, (α -methylaminopiperonyl)-, di Et ester, -HCl, 1978³.
- $C_{11}H_{21}NO_5S$ Homatropine, *N*-sulfonated ether, 384⁵.
- $C_{11}H_{21}N_2OP$ Phosphinous acid, bis(dimethylaminophenyl), 1973⁹.
- $C_{11}H_{21}N_3$ Benzidine, 3-amino-*N*, *N*, *N'*, *N'*-tetramethyl-, 3190⁹.
- $C_{11}H_{21}N_3O$ $\Delta^{2,3}$ - 4 - Octadienone, 6 phenyl (?), semicarbazone, 229⁷.
- Pyrrole, anisylazo-1-isoamyl, 2451⁴.
- $C_{11}H_{21}N_3O_2$ See *Ncophyrine*.
- $C_{11}H_{21}N_3O_2$ 2-Piperidone, 3-[(*N*-acetyl- β -phenylalanyl)amino]-, 2877².
- $C_{11}H_{21}N_3O_4$ Bornylamine, *N*-(2,4-dinitrophenyl), 405¹.
- Camphanylamine, *N* - (2,4 - dinitrophenyl)-, 405¹.
- $C_{11}H_{21}N_3O_5$ Adipic acid, α -keto-, di-Et ester, *p*-nitrophenylhydrazone, 90⁵.
- $C_{11}H_{21}ClN$ Fencholimidyl chloride, *N*-phenyl, 2875⁸.
- $C_{11}H_{21}N_2O$ Cinchoninamide, 2-cyclohexyl-1,2,3,4-tetrahydro-, 915¹.
- 1(2) - Quinolinecarboxanilide, octahydro-, 2903⁴.
- $C_{11}H_{21}N_2O_2$ 2(1)-Pyrimidone, 4,6-epoxy-4,5,6-triethyltetrahydro-5-phenyl(?), 3351⁹.
- $C_{11}H_{21}N_2O_4$ Cyclohexanol, 2-(dimethylaminomethyl)-, *p*-nitrobenzoate, -HCl, 1970⁴.
- Nipecotic acid, 1- β -hydroxyethyl-, Me ester, *p*-aminobenzoate, -HCl, 1977¹.
- $C_{11}H_{21}N_4$ Biphenyl, 3,3'-diamino-4,4'-bis(dimethylamino)-, 238².
- $C_{11}H_{21}N_4O_4$ Benzene, 1,5-dinitro-2,4-di-1-piperidyl-, 2681⁴.
- $C_{11}H_{21}O$ 2-Naphthol, 3-cyclohexyl-5,6,7,8-tetrahydro-, 1114⁸.
- $C_{11}H_{21}O_2$ Benzene, 2-allyloxy-3-methoxy-1-propenyl-5-propyl-, 72².
- Guaiacol, 6 - (β - methyl- Δ^1 -4-pentadienyl)-4-propyl-, 72².
- $C_{11}H_{21}O_2S_2$ Phthalic acid, dithiol, di-Bu ester, 3192⁹.
- $C_{11}H_{21}O_3$ Δ^1 - 3 - Nonenone, 1-(4-hydroxy-*m*-anisyl)-, 3623⁸.
- $C_{11}H_{21}O_3$ Malonic acid, (β -benzyloxyethyl)-, di-Et ester, 1639².
- $C_{11}H_{21}O_3S$ 1,5-Glucose, 4-*p*-toluenesulfonyl-1,2-isopropylidene-, 64¹.
- $C_{11}H_{21}O_{11}$ *d*-Glucose, pentaacetate, 3184^{4,8}.
- Mannose, pentaacetate, 1969⁴, 3184^{4,8}.
- $C_{11}H_{21}NO_2$ 2-Butanone, 3-benzyl 4-(1 piperidyl) -, -HCl, 1121³.
- α -Hexeno-*p* toluide, β -propyl-, 3187⁸.
- 2-Pentanone, 1-phenyl-5-(1-piperidyl)-, 2271².
- $C_{11}H_{21}NO_2$ Butyric acid, cyclohexylamino-phenyl-, 2876⁴, 2882².
- Cyclohexanol, 2 - (dimethylaminomethyl)-, benzoate, -HCl, 1970^{4,8}.
- Nicotinic acid, menthyl ester, P 593².
- Picolinic acid, menthyl ester, P 593².
- $C_{11}H_{21}NO_4$ Adipanic acid, tetramethyl-, 1968².
- $C_{11}H_{21}NO_4$ Butyric acid, α -(amylamino)- γ -(3,4 methylenedioxyphenyl)-, 2882⁹.
- $C_{11}H_{21}N_2O_2$ Benzene, 1-nitro 2,4-di-1-piperidyl-, 2681⁴.
- $C_{11}H_{21}N_2O_5$ Guanidine, α -isoamyl-, picrolonate, 62⁹.
- $C_{11}H_{21}ClCoN_4O_5S$ + 2H₂O, 868⁸.
- $C_{11}H_{21}ClCoN_4O_5$ + H₂O, 868⁸.
- $C_{11}H_{21}CoN_4S$, 868⁸.
- $C_{11}H_{21}CoN_4O_5$, 868⁸.
- $C_{11}H_{21}NO$ Morphopiperidine, *N*- β -methylbenzyl-, methiodide, 413¹.
- $C_{11}H_{21}N_2$ Isoquinoline, 1,2,3,4 tetrahydro 2-(β -1-piperidylethyl), 410¹.
- $C_{11}H_{21}N_2O_6$ 2-Butanone, 3-benzyl-4 (1-piperidyl)-, oxime, -HCl, 1121³.
- $C_{11}H_{21}N_2O_2$ Cyclohexanol, 2-(dimethylaminomethyl)-, *p*-aminobenzoate, and -HCl, 1970⁴.
- Isophthalamide, *N*, *N*, *N'*, *N'*-tetraethyl-, 1980⁷.
- Phthalamide, *N*, *N*, *N'*, *N'*- tetraethyl-, 1980⁷.
- Terephthalamide, *N*, *N*, *N'*, *N'*-tetraethyl-, 1980⁷.
- Valeramide, *N*, *N'*-*p* phenylenebis-, 2884⁸.
- $C_{11}H_{21}N_4O_5$ 2-Butanol, 1-(β -dimethylaminoethoxy)-2-methyl-, *m*-nitrobenzoate, -HCl, 3889⁷.
- $C_{11}H_{21}N_4O_7$ 3-*p*-Menthylamine, picrate, 796².
- $C_{11}H_{21}N_4O_8$ 2-Butanol, 2-methyl-3-(1-piperidyl)-, picrate, 2271⁴.
- $C_{11}H_{21}O_3$ 3-Nonanone, 1-(4-hydroxy-*m*-anisyl)-, 3623⁸.
- $C_{11}H_{21}O_3S$ Benzenesulfonic acid, menthyl ester, 1642^{2,9}.
- $C_{11}H_{21}N$ Pentenylamine, *N*-amyl-*e*-phenyl-, -HCl, 2883¹.
- $C_{11}H_{21}NO$ 2-Butanol, 3-benzyl-4-(1-piperidyl)-, 1121³.
- $C_{11}H_{21}NO_4$ Butyric acid, α -(amylamino)- γ , *p*-tolyl, 2882⁸.

- Glycine, *N*-(γ -*p*-cumenylpropyl)-, Et ester, 1461².
- Guaiacol, 5 - (γ -1-piperidylbutyl)-, 1449⁶.
- C₁₆H₃₅NO₂ 2-Butanol, 1-(β -dimethylaminoethoxy)-2-methyl-, benzoate, -HCl, 3889⁷.
- C₁₆H₃₅NO₂ Benzylamine, α -*tert*-amyl-, acid tartrate, 3347¹.
- C₁₆H₃₅NO₁₁ *d*-Glucosamide, pentaacetyl-, 1634².
- C₁₆H₃₅ Naphthalene, cyclohexyloctahydro-, 1114^{4,7}.
- C₁₆H₃₅BrN₂O₄ Piperazine, 1,4-bis[*N*-(α -bromopropionyl)glycyl]-2,5-dimethyl-, 384¹.
- C₁₆H₃₅INO₂ (α -Carboxy- β -phenylbutyl)-trimethylammonium iodide, Et ester, 59².
- C₁₆H₃₅N₂ 1,6-Hexanediamine, *N* - (1,2,3,4-tetrahydro-2-naphthyl)-, and salts, 566⁶.
- C₁₆H₃₅N₂O Nicotinamide, *N*, *N*-diamyl-, P 250⁴.
- C₁₆H₃₅N₂O₂ See *Alypine*.
- C₁₆H₃₅N₂O₂ Cinchophen, hexadecahydro-1-nitroso-, 915².
- 2-Propanol, 1-dimethylamino-3-(β -dimethylaminoethoxy)-, benzoate, 3889⁷.
- C₁₆H₃₅N₂O₄ Gluconic acid, 2,3,5,6-tetramethyl-, phenylhydrazide, 1101⁶.
- Mannolactone, tetramethyl-, phenylhydrazide, 2879⁴.
- C₁₆H₃₅N₄O₄ Spiro[1,3,5,2-oxidiazine-2,1'-cyclobutane-3',2''-1,3,5,2-oxidiazine]-4,4''(3,3'')-dione, 5,6,5'',6''-tetrahydro-3,5,2',4',3'',5''-hexamethyl-6,6''-bis(methylimino)-, 2131².
- C₁₆H₃₅O Ether, decyl phenyl, 2658⁷.
- C₁₆H₃₅O₂ Acid from whale oil, 1366².
- C₁₆H₃₅O₄ Cyclohexanol, 2-cyclohexyl-, acid succinate, 375⁴.
- C₁₆H₃₅O₄ Cyclohexanemalonic acid, 2-carboxy-, tri-Et ester, 586⁹.
- C₁₆H₃₅N₂ Diamylamine, ϵ -phenyl-, and -HCl, 2883¹.
- C₁₆H₃₅NO₂ Cinchophen, hexadecahydro-, 914⁶.
- C₁₆H₃₅ Naphthalene, 1(and 2)-cyclohexyl-decahydro-, 1114⁵.
- C₁₆H₃₅N₂ Sparteine, methyl-, 583³.
- 1,13-Tridecanedinitrile, methyl-, 3349⁹, 3350¹.
- C₁₆H₃₅N₂O₄ Adipic acid, α , δ -di-1-piperidyl-, and *di*-HCl, 59⁴.
- C₁₆H₃₅O Naphthol, cyclohexyldecahydro-, 1114^{4,4}.
- C₁₆H₃₅O₂ Ambrettolic acid, lactone, 2118⁹.
- Hydnocarpic acid, 2168⁹, 2958⁴.
- C₁₆H₃₅O₄ Glutaric acid, α -isocaproyl- α -methyl-, *di*-Et ester, 578².
- C₁₆H₃₅O₂ Borneolglucuronic acid, 3373⁶.
- C₁₆H₃₅NO₂ Butyric acid, γ -cyclohexyl- α -cyclohexylamino-, 2882⁷.
- C₁₆H₃₅Cl₂O₂ Palmitic acid, α , α -dichloro-, 2875⁹.
- C₁₆H₃₅N₂O₂ 2(1)-Pyrimidone, 4,6-dibutyl-4,6-epoxy-5,5-diethyltetrahydro-(?), 3351⁹.
- C₁₆H₃₅N₂O₄ Piperazine, 1,4-bis[*N*-(α -alanylglycyl)-2,5-dimethyl-, and *di*-HBr, 384¹.
- C₁₆H₃₅O See *Muscione*.
- C₁₆H₃₅O₂ Cyclohexanol, *sec*-butylidenehi-, P 2273⁹.
- Hypogaeic acid, 2661⁷.
- Juniperic acid, lactone, 2119¹.
- Palmitoleic acid, 2661⁸.
- γ -Pentadecenic acid, γ -methyl-, 2874³.
- Pentadecenic acid, methyl ester, 2874^{1,2}.
- Physeteleic acid, 2661⁸.
- λ -Tridecenic acid, α -methyl-, ethyl ester, 2873⁸.
- Zoomaric acid, 1719⁵.
- C₁₆H₃₅O₂ Ambrettolic acid, 2118⁹.
- Lauric acid, α -acetyl-, Et ester, 2658⁹.
- C₁₆H₃₅O₄ Acids, m. 68-9° and 78°, from muscone, 901⁸.
- 1,10-Dodecanedicarboxylic acid, *di*-Et ester, 3182⁴.
- 1,12-Dodecanedicarboxylic acid, mono-Et ester, 3911¹; *Na* salt, 3182⁴.
- Thapsic acid, 3909⁶.
- 1,13-Tridecanedicarboxylic acid, methyl-, 3349⁹, 3350^{1,2}.
- C₁₆H₃₅NO₂ Caprylic acid, cyclohexylamino-, ethyl ester, and -HCl, 2876⁸.
- C₁₆H₃₅NO₂ Myristic acid, ν -carbamyl- β (or μ)-methyl-, 3349⁹.
- C₁₆H₃₅ See *Citene*.
- C₁₆H₃₅Au₂Cl₂S₂, 3495⁹.
- C₁₆H₃₅Au₂Cl₂S₂, 3495⁹.
- C₁₆H₃₅Cr₂O₂S₂, 865⁴.
- C₁₆H₃₅N₂O₂ 1,6-Hexanediol, 2,5-di-1-piperidyl-, and isomer, and *di*-HCl, 59^{4,2}.
- C₁₆H₃₅N₂O₂ Suberic acid, α , δ -bis(diethylamino)-, and isomer, 60⁷.
- C₁₆H₃₅O Muscol, 571⁹.
- Δ^4 -1-Pentadecenol, 4-methyl-, 2874³.
- C₁₆H₃₅O₂ (See also *Palmitic acid*.)
- Lauric acid, Bu ester, P 593³.
- Myristic acid, ethyl ester, 2874⁴.
- ν -Pentadecic acid, α -methyl-, 2250¹.
- C₁₆H₃₅O₂ Palmitic acid, α -mercapto-, 3045⁹.
- C₁₆H₃₅O₂ Juniperic acid, 2118⁹.
- C₁₆H₃₅O₄ Palmitic acid, dihydroxy-, 2119⁹.
- C₁₆H₃₅O₂ Aleuritic acid, 1797³.
- C₁₆H₃₅N₂O₂ Isocaproamide, α , α' -iminobis[*N*-ethyl-, -HCl, 1657⁹].
- Propionamide, α , α' -iminobis[*N*-isocamyl-, and -HCl, 1657⁹].
- C₁₆H₃₅Br₂O₂PtS₂ Thiophene, tetrahydro-, 1,5-hydroxybutyl bromoplatinate, 1639⁴.
- C₁₆H₃₅IN₂O₂ Adipic acid, α , δ -bis(dimethylamino)-, *di*-Et ester, dimethiodide, 59⁴.
- C₁₆H₃₅N Cetylamine, 1962².
- C₁₆H₃₅CrN₂O₁₁, 1601².
- C₁₆H₃₅Ge Germane, tetrabutyl-, 3897¹.
- C₁₆H₃₅Cl₂N₂O₂Pt (Isobutoxymethyl)trimethylammonium chloroplatinate, 2660².
- C₁₆H₃₅FeCl₂N₂ Butylammonium heptachloroferrate, 711⁷.
- (C₁₆H₃₅) Potassium carbides, 1582⁹.
- C₁₇H₃₅Br₂O₂ Resorcinolcitraconein, tetrabromo-, 3194⁹.
- C₁₇H₃₅Br₂O₂ Resorcinolitaconein, tetrabromo-, dibromide, 3194⁹.
- C₁₇H₃₅N₂O₄ 1,2-Benzacridine-5,6-dione, 8-nitro-, 1122⁷.
- C₁₇H₃₅N₂O₂ Pseudoisatin, 5,5'-carbonylbis-, 1123³.
- C₁₇H₃₅Cl₂NO₂ Benzoic acid, *p*-(tetrachlorophthalimido)-, Et ester, 378⁴.
- C₁₇H₃₅N₂O₁₃ 1-Picrylpyridinium picrate, 93².
- C₁₇H₃₅BrN₂S β , β -Naphthothiazole, 3-bromo-1-phenyl-, 2692⁴.
- C₁₇H₃₅Br₂N₂O Phenanthrazine, acetamidodibromo-, 2895³, 3201³.
- C₁₇H₃₅Br₂N₂O₂ Δ^2 -3-Pyrazolinescarboxylic acid, 1-(2,4-dibromophenyl)-4,5-diketone, methyl ester, 4-(2,4-dibromophenyl)hydrazone, 2894⁴.
- C₁₇H₃₅N₂O₂ Acridamide, Naphthyl-, 2697⁴.
- C₁₇H₃₅N₂O₂ Pyrocatecholimidazomalein, 3198⁴.
- Resorcinolimidazomalein, 3198⁴.

- $C_{17}H_{10}N_2O_7$ 3198⁴. Phloroglucinolimidazomaleein, Quinolimidazomaleein, hydroxy-, 3198⁴.
- $C_{17}H_{10}N_4O_2$ Furo[3,2-f]quinoline, picrate, 3827.
- $C_{17}H_{10}N_4O_{11}$ Dinitrophenylpyridonium picrate, 1397².
- $C_{17}H_{10}N_2O_4$ Phenanthiazine, 3-acetamido-6,11-(and 8,9)-dinitro-, 3201⁴.
- $C_{17}H_{10}O$ Benzanthrone, P 1361⁴.
- $C_{17}H_{10}OS_2$ 1,3-Benzodithiole, 2-[2-keto-1(2)-naphthylidene], and -HCl, 1985².
- $C_{17}H_{10}O_2$ 7-meso-Benzanthrenone, 2-hydroxy-, P 3058⁴.
- $C_{17}H_{10}O_4$ 7-meso-Benzanthrenone, trihydroxy-, and H_2SO_4 salt, 28947³.
- $C_{17}H_{10}O_5$ 1,4-Naphthoquinone, 5,6-dihydroxy-, monobenzoate, 3053².
- $C_{17}H_{10}O_8$ Anthraquinonecarboxylic acid, carboxymethylmercapto-, P 1018².
- $C_{17}H_{10}O_7$ Pyromellitic anhydride, anisole addn. compd., 1455⁴.
- $C_{17}H_{11}Br$ Chrysouluorene, 11-bromo-, 239¹, 581⁴.
- $C_{17}H_{11}BrN_2O_2$ α,γ - Pentadienenitrile, α -(bromophenyl)- γ -nitro- δ -phenyl-, 223^{2,3}.
- $C_{17}H_{11}BrNO$ Phenanthiazine, 3-acetamido 6-bromo-, 3201³.
- $C_{17}H_{11}BrO_4$ Benzoic acid, *m*-bromo-, mixed anhydride with β -benzoylacrylic acid, 2259².
- $C_{17}H_{11}Cl$ Chrysouluorene, 11-chloro-, 239², 581⁴.
- $C_{17}H_{11}ClO$ 2,1 - Indenoindene, 10-chloro-5-methoxy-, 84².
- $C_{17}H_{11}ClO_2$ 2-Indanacetyl chloride, 1,3-di-keto-2-phenyl-, 1647⁴.
- $C_{17}H_{11}ClO_4$ Benzoic acid, *p*-chloro-, mixed anhydride with β -benzoylacrylic acid, 2259².
- $C_{17}H_{11}I$ Chrysouluorene, 11-iodo-, 239³, 581⁴.
- $C_{17}H_{11}N$ 2,3-Benzacridine, and chloroplatinate, 1123².
- $C_{17}H_{11}NO_2$ Compd., m. 208°, from condensation of indole and niuhydin, 91⁴.
- $C_{17}H_{11}NO_4$ Phthalimide, *N*-(3,1 methylene-dioxyethyl)-, 1462².
- $C_{17}H_{11}NO_7$ See *Aristolochene*.
- $C_{17}H_{11}N_2O_2$ Benzoxazole, 4-(2-hydroxy-1-naphthylazo)-, 3363².
- $C_{17}H_{11}N_2O_3$ Salicylonitrile, 5 - (2 - hydroxy-1-naphthylazo)-, 3363².
- $C_{17}H_{11}N_2O_4$ 1,2-Benzacridine, 5,6-dihydro-8,10-dinitro-(?), 1122⁴.
- Benzaldehyde, 4 - (2 - hydroxy 1 naphthylazo)-3-nitro-, 1254⁷.
- α,γ - Pentadienenitrile, γ,δ -dinitro- α,δ -diphenyl-, 222².
- , γ - nitro - α - (*p* - nitrophenyl) δ -phenyl-, 223².
- $C_{17}H_{11}N_4NaO_2$ 3(5) - Pyrazo[3,4- δ]pyridazinone, 4 - hydroxy - 2,5 - diphenyl-, Na deriv., 1978⁴.
- $C_{17}H_{11}N_4O_2$ Phenanthiazine, 3-acetamido-6(and 8)-nitro-, 3201².
- $C_{17}H_{11}BrN$ α,γ -Pentadienenitrile, α -(bromophenyl)- δ -phenyl-, 223².
- $C_{17}H_{11}BrN_2O_4$ α -Pentenitrile, α -(*m*(and *p*)-bromophenyl) - γ,δ - dinitro - δ - phenyl-, 223^{2,3}.
- $C_{17}H_{11}BrN_2O_5$ Quinoline, 2-(α,β -dibromo-*m*-nitrophenethyl)-, 580^{3,4}.
- $C_{17}H_{11}BrN_2O_6$ Δ^2 - 3 - Pyrazolincarboxylic acid, 1 - (*p* - bromophenyl) - 4,5 - diketo-, methyl ester, 4-*p*-bromophenylhydrazone, 2890⁴.
- $C_{17}H_{12}Br_2O_2$ Δ^2 - 1,4 - Butenedione, 1,4-bis-(bromophenyl)-2-methoxy-, 82².
- $C_{17}H_{12}ClN$ 1,2-Benzacridine, 2-chloro-5,6-dihydro-, 1123².
- $C_{17}H_{12}ClN_2$ Imidazo[5,4- η]quinoline, 4-chloro-1-*p*-tolyl-, 2691⁴.
- $C_{17}H_{12}ClN_2O_2$ (Nitro-*o*-tolylazo) - 1 - naphthalenediazonium chloride, 380³.
- $C_{17}H_{12}Cl_2O_2$ 9 - Anthracenecarbinol, 1,5-dichloro-, acetate, 1260^{4,5}.
- $C_{17}H_{12}N_2$ 1,2-Benzacridine, 7-amino-, and -HCl, 1122².
- $C_{17}H_{12}N_2O_2$ 1,2 - Benzacridine, 5,6-dihydro-8-nitro-, and salts, 1122².
- α,γ - Pentadienenitrile, γ -nitro- α,δ -diphenyl-, 222².
- Quinaldine, α -(*m*-nitrobenzyl)-, 586⁴.
- $C_{17}H_{12}N_2O_2$ Acridinanic acid, 2697².
- $C_{17}H_{12}N_2O_4$ Phenolimidazomalecin, 3198⁴.
- $C_{17}H_{12}N_2O_5$ Glyceraldehyde, bis(*p*-nitrobenzoate), 1797⁴.
- 2 - Propanone, 1,3 - dihydroxy-, bis(*p*-nitrobenzoate), 1797⁴.
- $C_{17}H_{12}NO$ Benzoxazole, 4-(2-amino-1-naphthylazo)-, 3363².
- Salicylonitrile, 5 - (2 - amino-1-naphthylazo)-, 3363².
- $C_{17}H_{12}N_2O_2$ 3(5) - Pyrazo[3,4- δ]pyridazinone, 4-hydroxy-2,5-diphenyl-, 1973².
- 1,4-Pyrene, 2,6-bis(phenylazo)-, 3192⁷.
- $C_{17}H_{12}N_2O_6$ 2 Naphthylamine, *N*-benzyl-1,6,8-trinitro-, 404⁴.
- 2 - Naphthylamine, *N*-methyl-1,6,8-trinitro-*N*-phenyl-, 404⁴.
- , 1,6,8 trinitro-*N*-tolyl-, 404⁷.
- $C_{17}H_{12}N_2O_8$ Quinoline, 3-methyl-6,7-methylene-dioxy-, picrate, 585⁴.
- $C_{17}H_{12}O$ Ketone, 1-naphthyl phenyl, 3616⁴.
- $C_{17}H_{12}O_2$ Benzoic acid, 2-naphthyl ester, 3102⁷.
- Ketone, 2-hydroxy-1 naphthyl phenyl, 3616⁴.
- $C_{17}H_{12}O_4$ (See also *Betol*).
- Alcohol, 3291⁷.
- Coumarin, 3-benzoylmethyl-, 378⁴.
- Naphthoquinone, 2-benzyl 3-hydroxy-, 241⁴.
- , benzoyloxy-, 241⁴.
- $C_{17}H_{12}O_4$ 2-Indanacetic acid, 1,3-diketo-2-phenyl-, and salts, 1647⁴.
- 1 - Isobenzofuranpropionic acid, 1,2-dihydro-1 - hydroxy - 2 - keto - β - phenyl-, γ -lactone, 1647⁷.
- Umbelliferone, 3-phenyl-, acetate, 3193².
- $C_{17}H_{12}O_8$ Anthracenecarboxylic acid, carboxymethylmercapto-, P 1018².
- $C_{17}H_{12}O_9$ Flavone, 3-methoxy 3',4'-methylene-dioxy-, 3194⁴.
- Pyrocatecholitraconein, 3194⁴.
- Pyrocatecholitaconein, -HCl, 3194⁷.
- Resorcinolitraconein, 3194⁴.
- Resorcinolitaconein, 3194⁷.
- $C_{17}H_{12}O_9$ Fukugetin, 2269¹.
- $C_{17}H_{12}O_7$ Phloroglucinolitraconein, 3194⁴.
- Phloroglucinolitaconein, 3194⁷.
- Pyrogallolitraconein, 3194⁴.
- Pyrogallolitaconein, 3194⁷.
- $C_{17}H_{12}AsClN$ Benzophenarsazine, chlorodihydro-methyl-, 98⁴.
- $C_{17}H_{12}Br_2Cl_2$ Anthracene, 7-bromo-1,5-dichloro-9 isopropyl-, dibromide, 1260⁴.
- $C_{17}H_{12}ClN_2$ Imidazo[5,4- η]quinoline, 4-chloro-1-phenyl-, methiodide, 2691⁴.
- $C_{17}H_{12}ClN_2O_4$ Pyruvohydroxymethyl chloride, oxime, di-Bz deriv., 1099⁴.

- C₁₇H₁₃ClN₃O₈ 1,2-Propanediol, 3-chloro-, bis(*p*-nitrobenzoate), 1096².
- C₁₇H₁₃ClO₅ 3-Pentadienone, 1-(chlorophenyl)-5-salicyl-, 2258⁷.
- C₁₇H₁₃ClN₃O₄ 2,1,3-Benzotriazole-4,5-diol, 6,7-dichloro-2-*p*-tolyl-, diacetate,
- C₁₇H₁₃FN₃O₈ *p*-Toluenesulfonyl fluoride, 3-(2-hydroxy-1-naphthylazo)-, 3604⁴.
- C₁₇H₁₃N₃ 1,2-Benzacridine, 5,6-dihydro-, -HNO₃, 1122².
- C₁₇H₁₃NO 7-Benzocarbazole, 2-methoxy-, 1651¹.
Naphthanilide, 971².
Naphthylamine, salicylal-, 2613².
- C₁₇H₁₃NO₂ Benzamide, *N*-(7-hydroxy-2-naphthyl)-, 909⁷.
Benzoic acid, *p*-2-quinolyl-, Me ester, 2695².
Cinchophen, methyl-, 2695².
Isoquinoline, 1-benzyl-6,7-methylene-dioxy-, 1462².
3-Quinolinecarboxylic acid, 2-phenyl-, Me ester, 2695².
- C₁₇H₁₃NO₂ 2-Indanacetamide, 1,3-diketo-2-phenyl-, 1647².
Oxyquinoline, 1,2-dimethoxy-, 1984².
o-Toluic acid, α -hydroxy- α -(2-methyl-3-pseudoindylidene)-, 242².
- C₁₇H₁₃NO₄ Benzoic acid, (2,3-diketo-5-phenyl-1-pyrrolidyl)-, 2902².
Benzoic acid, *p*-phthalimido-, Et ester, 378⁴.
Phthalimide, *N*-(*p*-methoxyphenacyl)-, 2473².
- C₁₇H₁₃NO₅ Phthalamic acid, *N*-(3,4-methylenedioxyethyl)-, 1462².
- C₁₇H₁₃N₃ Imidazo[4,5-*f*]quinoline, 3-*p*-tolyl-, 2691².
- C₁₇H₁₃N₃O₂ α -Pentenitrile, γ , δ -dinitro- α , δ -diphenyl-, 222².
- C₁₇H₁₃N₃O₂ *m*-Phenylenediamineimidazomalein, 3198².
- C₁₇H₁₃N₃O₅ 1-Naphthalenediazosulfonic acid, [4(and 5)-nitro-*o*-tolylazo]-, and Na salts, 380².
- C₁₇H₁₃N₃O₇ 1,2,4-Triazole-1-*p*-benzonitrile, 3,5-dimethyl-, picrate, 3620².
- C₁₇H₁₃BrNO Benzamide, *N*-(1-bromo-2-naphthyl)-, 2692².
- C₁₇H₁₃BrNO₃ Quinaldine, 3-(*p*-bromophenylsulfonyl)-8-methoxy-, and salts, 411².
Homopiperonylamine, 6-bromo-*N*-piperonylidene-, 1270².
- C₁₇H₁₃BrN₃ Benzamide, *N*-(1-bromo-2-naphthyl)thio-, 2692².
- C₁₇H₁₃Br₂O₃ Pentanedione, dibromodiphenyl-, 1645².
1,3-Pentanedione, 4,5-dibromo-1,5-diphenyl-, 2902¹.
- C₁₇H₁₃ClNO₃ Quinaldine, 3-(*p*-chlorophenylsulfonyl)-8-methoxy-, and salts, 411².
Quinoline, 2-chloro-8-methoxy-3-*p*-tolylsulfonyl-, 1122².
- C₁₇H₁₃ClNO₅ Quinoline, 3-(*o*-anisylsulfonyl)-2-chloro-8-methoxy-, 1122².
- C₁₇H₁₃ClN₃O₇ Pyrazole, benzylchloromethyl-, picrate, 2899¹.
- C₁₇H₁₃Cl₂O Ether, 1,5-dichloro-9-anthrilylmethyl ethyl-, 1260².
- C₁₇H₁₃IN₃ Imidazo[4,5-*f*]quinoline, 2(and 3)-phenyl-, methiodide, 2691².
- C₁₇H₁₃N₃ 1,2-Benzacridine, 8-amino-5,6-dihydro-, and -HCl, 1122².
- C₁₇H₁₃N₃O₂ Cinchophen, 3-amino-4'-methoxy-, 2474².
- 4-Quinazolinecarboxylic acid, 2-(*p*-hydroxyphenyl)-, Et ester, 3905².
-, 2-salicyl-, Et ester, 3905².
- C₁₇H₁₃N₃O₂ Glyoxime, methyl-, di-Bz deriv., 1099².
- C₁₇H₁₃N₃O₂ Pyruvohydroxamic acid, oxime, di-Bz deriv., 1097².
- C₁₇H₁₃N₃O₂ Hydracrylic acid, β -(4,5-methylenedioxy-2-nitrophenyl)- α -(*o*-nitrophenyl)-, Me ester, 3608².
- C₁₇H₁₃N₃O₅ 2,4-Thiazolidione, 3-benzal-amino-, benzalhydrazono-, 245².
- C₁₇H₁₃N₃O₂ 1-Naphthylamine, (nitro-*o*-tolylazo)-, 380².
Osotetrazine, 2,3-dibenzoyl-5-methyl-, 927².
1,2,3-Triazole, 1-dibenzoylamino-4(and 5)-methyl-, 927².
- C₁₇H₁₃O Ether, 1(and 2)-naphthylmethyl phenyl-, 580².
3-Pentadienone, 1,5-diphenyl-, 1974¹, 3042¹.
- C₁₇H₁₃O₂ Cyclopropane, 1,2-dibenzoyl-, 1845².
1-Indanone, 2-benzal-5-methoxy-, 2268².
Propiophenone, 2-methoxy-5-methyl- β -phenyl-, 1255².
- C₁₇H₁₃O₂ Δ^3 -2-Butenone, 4-(*p*-hydroxyphenyl)-, benzoate, 1449².
1-Indanone, 2-(hydroxymethyl)-, benzoate, 582².
3-Pentadienone, 1,5-bis(hydroxyphenyl)-(?), 3609².
Propiophenone, 2,5-dimethoxy- β -phenyl-, 1255².
- C₁₇H₁₃O₄ Anthraquinone, 2,4-dimethoxy-1-methyl-, 3053².
Coumarin, 5,7(and 7,8)-dimethoxy-3-phenyl-, 3193².
Flavanone, 7-hydroxy-, acetate, 3193².
Flavone, 3',4'-dimethoxy-, 3194².
Phenolcitraconein, 3194².
Phenolitaconcin, 3194².
- C₁₇H₁₃O₄ Compd., m. 220-1°, from 2-allyl-3-hydroxy-1,4-naphthoquinone and AcO, 241².
Flavone, 3-hydroxy-3',4'-dimethoxy-, 3194².
Glyceraldehyde, dibenzoate, 1797².
Hydrocinamic acid, β -(*o*-carboxybenzoyl)-, 1647².
Isoflavone, 5,7-dihydroxy-4'-methoxy-2-methyl-, 246².
- C₁₇H₁₃O₆ Anthraquinone, 1-hydroxy-2,5,6-trimethoxy-, 910².
Luteolin, 3-ethyl-, 2270².
- C₁₇H₁₃BrO₃ Chalcone, α -bromo- β -ethoxy-, 77².
C₁₇H₁₃BrO₃ Propionic acid, β -benzoyl- β -bromo- α -phenyl-, Me ester, 593².
- C₁₇H₁₃BrO₃ Meconin, 2-(bromoanisyl)-, 3356².
Meconin, 2-(5-bromo-4,3-cresyl)-, 3356².
- C₁₇H₁₃BrO₃ Meconin, 2-(5-bromo-2-hydroxy-m-anisyl)-, 910².
- C₁₇H₁₃BrN₃O₂ Hydrazine, β -(*o*-acetamidobenzoyl)- α -acetyl- α -(2,4-dibromophenyl)-, 1638².
- C₁₇H₁₃ClO 1-Indanone, 3-chloro-2,2-dimethyl-3-phenyl-, 3614².
- C₁₇H₁₃ClO₂ 5,7-Dihydroxy-3,4'-dimethoxyflavylium chloride, 3620².
- C₁₇H₁₃ClO₂ 5,7,4'-Trihydroxy-3',5'-dimethoxyflavylium chloride, 3624².
- C₁₇H₁₃N Quinoline, 6,8-dimethyl-3-phenyl-, and chloroplatinate, 3622².
- C₁₇H₁₃NO Quinoline, 2-*p*-anisyl-6-methyl-, and chloroplatinate, 3622².

- C₁₇H₁₅NO₂ Δ² - 1,4 - Butenedione, 2-methyl-amino-1,4-diphenyl-, 827.
 β-Butenic acid, γ-phenyl-α-p-tolylimino-, 2902².
 1-Indanone, 2 - (N - methoxyanilino-methylene)-, 582².
 2-Indolecarboxylic acid, 3-phenyl-, Et ester, 1269².
 Isoquinoline, 6,7 - dimethoxy - 1 - phenyl-, 1655².
 1(2) - Naphthalenone, 3,4-dihydro-7-salicylalamino- 1123⁴.
 γ-Pentenamide, β-keto-δ-phenyl-, 734².
 Δ⁴ - 1,3 - Pentenedione, 5-anilino-1-phenyl-, 2901².
 2,3 - Pyrrolidinedione, 5-phenyl-1-*p*-tolyl-, 2902².
 C₁₇H₁₅NO₂ β-Butenic acid, α(*p*-anisylimino)-γ-phenyl-, 2902².
 Cinnamic acid, *p*-acetamidophenyl ester, 2893⁴.
 3-Indolinescarboxylic 1-benzoyl-7-methyl-, 9127.
 Phthalimide, N - (β - methoxyphenethyl)-, 1462².
 2,3 - Pyrrolidinedione, 1 - *p* - anisyl-5-phenyl-, 2902².
 C₁₇H₁₅NO₂S Quinaldine, 8-methoxy-3 (phenyl-sulfonyl)-, and salt, 4114².
 C₁₇H₁₅NO₂ Benzanilide, *o*'-acetyl-*p*-hydroxy-, acetate, 3905².
 Benzoic acid, *p*-nitro-, 5,6,7,8-tetrahydro-2-naphthyl ester, 1983².
 —, *p*-piperonalamino-, Et ester, 378².
 C₁₇H₁₅NO₂S Carbostryl, 8 methoxy-3 *p* tolyl-sulfonyl, 1122².
 C₁₇H₁₅NO₂S Carbo-tyril, 3-(*o*-anisylsulfonyl)-8-methoxythio-, 1122².
 C₁₇H₁₅NO₂ 3,4 Chromandione, 2-(3,4-dimethoxyphenyl), 3-oxime, 3194².
 C₁₇H₁₅NO₂S Carbo-tyril, 3 (*o*-anisylsulfonyl)-8-methoxy-, 1122².
 C₁₇H₁₅N₂O₂ 1,2,4-Triazol-5-ol, 1-phenyl-3 *p*-tolyl-, acetate, 743².
 C₁₇H₁₅N₂O₂ Acetoacetanilide, α-(*o* formyl-phenylazo), 764.
 Benzaldehyde, *p*-nitro-, (β-benzoylvinyl)-methylhydrazone, 1450².
 C₁₇H₁₅N₂O₂ Protocatechualdehyde, bis(methyl carbonate), *p* - nitrophenylhydrazone, 2886².
 C₁₇H₁₅N₂O₂ Gallaldehyde, bis(methyl carbonate), *p* - nitrophenylhydrazone, 2886².
 C₁₇H₁₅N₂O₂ 3,5(2,4) - *av* - Triazinolone, 2-*p*-tolyl-6-*p*-tolylazo-, 1654².
 C₁₇H₁₅N₂O₂S Hydrazinesulfonic acid, β-((5 - nitro - *o* - tolylazo) - 1 - naphthyl), 3811.
 C₁₇H₁₅N₂O₂ 2,9-Pyridindole, 1,2,3,4-tetrahydro-, picrate, 3622².
 Quinoline, 8-amino-2,4 dimethyl, picrate, 3622².
 C₁₇H₁₅N₂O₂ Carhamic acid, (*o*-nitrophenyl azoglyoxyl)-, Et ester, *o* nitrophenyl hydrazone, 1654².
 C₁₇H₁₅ Anthracene, 1,2,4-trimethyl-, P 2478².
 C₁₇H₁₅BrNO₂ Benzamide, N-(6-bromohomopiperonyl)-N-methyl-, 1270².
 C₁₇H₁₅I₂N 1,3 - Dimethyl - 2 - phenylquinolinium iodide, 2695².
 1 - Methyl - 2 - *p* - tolylquinolinium iodide, 2695².
 C₁₇H₁₅N₂O Compd., m. 102-4°, from 2-benzyl-oxo - 2 - methyl - 5 - phenyl - 3(2)-pyrro-
 lone and aniline, 1100².
 Cresol, (3 - methyl - 1 - phenyl - 5 - pyra-
 zolyl), 2472².
 2 - Naphthylamine, 1-(*o*-aminophenyl)-7-
 methoxy, 1651².
 2-Pyrrolidone, 1-benzalamino-5-phenyl-,
 2897².
 Urea, *s*-distyryl-, 3900².
 C₁₇H₁₅N₂O₂ 1,2 Benzofurandione, 3,5-di-
 methyl, methylphenylhydrazone, 1116².
 Crotonanilide, β-amino-α benzoyl-, 734².
 Fluorenediamine, N, N'-diacetyl-, 238².
 2-Pyrrolidone, 5 - phenyl - 1 - salicylalamino-,
 2897².
 α - Tolunitrile, α - (hydroxyanilino)-α-
 methyl, acetate, 1794².
 C₁₇H₁₅N₂O₂S Carbanilide, *p*, *p*'-diacetylthio-,
 1637².
 C₁₇H₁₅N₂O₂S 4 - Quinazolinecarboxylic acid,
 1,2,3,4 - tetrahydro 4 - hydroxy - 3 -
 phenyl 2 thio keto-, Et ester, 587².
 4 - Quinazolinecarboxylic acid, 1,2,3,4-
 tetrahydro - 4 - methoxy - 3 - phenyl-
 2 thio keto-, Me ester, 587².
 Quinoline, 2 - amino - 8 - methoxy-3-*p*-
 tolylsulfonyl, and salt, 1122².
 C₁₇H₁₅N₂O₂ Benzanilide, *o*'-acetyl, *O*-carbo-
 methoxyoxime, 1119².
 Benzanilide, *o*' formyl-, *O*-carbethoxyoxime,
 1119².
 Protocatechualdehyde, diacetate, phenyl-
 hydrazone, 1107².
 C₁₇H₁₅N₂O₂S Quinoline, 2-amino-3-(*o*-anisyl-
 sulfonyl)-8-methoxy-, and salt, 1122².
 C₁₇H₁₅N₂O₂ Benzoic acid, *p*-(4-methyl-3-nitro-
 benzamido), Et ester, 1451².
 C₁₇H₁₅N₂O₂S Naphtholsulfonic acid, 5-nitro-
o-toluidine salt, 1646², 3361².
 C₁₇H₁₅N₂O₂ Hydrocinnamic acid, β methoxy-
o-nitro-α-(δ-nitrophenyl)-, Me ester, 2260².
 C₁₇H₁₅N₂S₂ 1,1,3-Isotriodiazine, 2-(ethylmer-
 capto)-4,5-diphenyl-, 391².
 1,4,3 - Isotriodiazine, 2 - (methylmer-
 capto)-4-phenyl-5-*p*-tolyl-, 391².
 C₁₇H₁₅N₂ Pyridine, 2,2'-(benzaldimino)bis-,
 1814².
 C₁₇H₁₅N₂O₂ 1,2,4 - Triazole, 1 - (benzamido-
 phenyl)-3,5-dimethyl-, 3200².
 C₁₇H₁₅N₂O₂ Piperidine, 1-[4-(2,4-dinitro-
 phenyl)-2-nitrophenyl], 379².
 C₁₇H₁₅O Chalcone, 4,4'-dimethyl-, 771.
 Chalcone, 4'-ethyl-, 771.
 C₁₇H₁₅O₂ Δ⁴ - 2 - Butenone, 4 - *o* - anisyl-1 (and
 3)-phenyl-, 80².
 Chalcone, β-ethoxy-, 398², 575².
 —, 2' (and 6')-hydroxy-3',5' (and 2',3')
 dimethyl-, 1255².
 —, 2'-methoxy-5' methyl-, 1255².
 Flavanone, 5,6 (and 6,8)-dimethyl-, 1255².
 1-Indanone, 3 - hydroxy - 2,2 - dimethyl-
 3-phenyl-, 3614².
 4,1-β-Naphthopyran, 1 - acetonil-3-methyl,
 1267².
 C₁₇H₁₅O₂ Anthracene, 1,2,7-trimethoxy-, 2895².
 9-Anthrone, 2,5-dimethoxy-6-methyl, 3194².
 2-Butanone, 4 - (*p* - hydroxyphenyl)-,
 benzoate, 1449².
 Chalcone, dimethoxy, 1255², 3612².
 —, 5'-ethoxy-2'-hydroxy, 1255².
 1,3-Propanedione, 1 - *p* anisyl-2-methyl-
 3-phenyl-, 81².
 —, 1-*p*-phenetyl-3-phenyl-, 81².
 C₁₇H₁₅O₂ 9-Anthrol, 3,4,6-trimethoxy-, 2895².
 Chalcone, 2'-hydroxy-3,4-dimethoxy-, 3194²

- Flavanone, 3',4'-dimethoxy-, 3194⁴.
 Phthalide, 2-*p*-anisyl-3-methoxy-4-methyl-, 3194⁴.
 1,3-Propanedione, 1-*m*-anisyl-3-*p*-anisyl-, 817.
 Propionic acid, β -benzoyl- β -hydroxy- α -phenyl-, Me ester, 5837.
 C₁₇H₁₈O₅ Meconin, 2-*o*(and *p*)-anisyl-, 3356⁸.
 Meconin, 2-(4,2-cresyl)-, 3356⁸.
 C₁₇H₁₈O₅ Methysticin, α -acetyl-, 2468⁹.
 C₁₇H₁₇BrN₃O₂ Piperidine, 1-[4-(*p*-bromophenyl)-2-nitrophenyl]-, 379⁸.
 C₁₇H₁₇BrN₃O₇ Benzylamine, *N*-(β -bromoallyl)- β -*N*-methyl-, picrate, 53⁸.
 C₁₇H₁₇BrO₅ *o*-Veratric acid, 6-(5-bromo-2-hydroxy-*m*-anisyl)-, 910².
 C₁₇H₁₇NO 2-Naphthol, 3-benzalmino 5,6,7,8-tetrahydro-, 1983⁸.
 Pentenanilide, β -phenyl-, 229¹.
 C₁₇H₁₇NO₂ (See also *Apomorphine*.)
 Acetanilide, *m*-(β -benzoyloethyl)-, 1799⁸.
 2(1-Benzofuranone, 1-anilino-1,3,5-trimethyl-, 911⁷.
 —, 1,4-dimethyl-1-*o*-toluino-, 911³.
 Crotonophenone, β -anilino-2-hydroxy-3-(and 5)-methyl-, 2472^{1,2}.
 Phenol, *o*-(Δ^2 -butenyl)-, carbanilate, 390⁸.
 —, *o*-(α -methylallyl)-, carbanilate, 390⁸.
 Quinoline, 1-benzoyl-1,2,3,4-tetrahydro-8-methoxy-, 1121⁸.
 C₁₇H₁₇NO₃ (See also *Dilaudid*.)
 3-Pyrrolicarboxylic acid, 5-formyl 2(β -methylstyryl)-, Et ester, 381⁴.
 C₁₇H₁₇NO₄ Benzamide, *N*-(β -methoxyhomopiperonyl)-, 1462².
 Phthalamic acid, *N*-(β -methoxyphenethyl)-, 1462².
 Propionic acid, β -benzoyl- β -hydroxy- α -phenyl-, oxime, Me ester, 583⁹.
 C₁₇H₁₇NO₅ Naphtholsulfonic acid, toluidine salt, 1646⁵, 3361⁸.
 C₁₇H₁₇NO₅ Naphtholsulfonic acid, anisidine salt, 1646⁵, 3361⁸.
 C₁₇H₁₇NO₅ Glycine, *N*-homopiperonyl-*N*-(phenylsulfonyl)-, 1461⁴.
 C₁₇H₁₇N₃ Anilopyrine, 1118⁸.
 3(4)-Pyridone, 5,6-dihydro Δ^2 -phenyl-, phenylhydrazone, and -HCl, 1270¹.
 C₁₇H₁₇N₂O₅ 2-Pyrrolidone, 5-phenyl-1 (phenylthiocarbamido)-, 2897³.
 C₁₇H₁₇N₂O₂ Δ^3 -2-Butenone, 1-phenyl-4-salicyl-, semicarbazone, 80⁸.
 Cinnamaldehyde, β -ethyl- β -(*p*-nitrophenyl)hydrazone, 1251⁴.
 C₁₇H₁₇N₂O₃ Naphthaldehyde, 1,2,3,4-tetrahydrohydroxy-, *p*-nitrophenylhydrazone, 1983⁷.
 Quinoxaline, 1,2,3,4-tetrahydro-2,3-dimethyl-1-(*p*-nitrobenzoyl)-, 1653⁸.
 C₁₇H₁₇N₂O₄ Carbazic acid, β -*N*-benzoylanthranyloyl-, Et ester, 2897⁸.
 C₁₇H₁₇N₂O₅ Pyruvic acid, (2-nitro-4,5-dimethoxyphenyl)-, phenylhydrazone, 1649⁹.
 C₁₇H₁₇N₂O₅ Carbamic acid, (phenylazoglyoxyl)-, Et ester, phenylhydrazone, 1654².
 C₁₇H₁₇BrNO Hydrocinnamamide, α -bromo-*N*-phenethyl-, 1658¹.
 C₁₇H₁₅Br₂N₂O₄ 4-Isopyrrolicarboxylic acid, 3-bromo-2-[(3-bromo-4-carboxy-5-methyl-2-pyrrolyl)methylene]-5-methyl-, di-Et ester, and -HBr, 381⁷.
 C₁₇H₁₅Br₂NO Pseudocumenol, 3,6-dibromo- α -(bromodimethylaminophenyl)-, 903².
 C₁₇H₁₅ClNO₂ Acetamide, α -chloro-*N*-(β -hydroxy- β , β -diphenylisopropyl)-, 568⁹.
 C₁₇H₁₅N₂ 1,2-Benzacridine, 8-aminohexahydro-, 1122⁷.
 C₁₇H₁₅N₂O Compd., m. 227°, from 4-ethyl-3,5-dimethyl-2-pyrrolealdehyde, 2701⁸.
 Naphthaldehyde, 5,6,7,8-tetrahydrohydroxy-, phenylhydrazone, 1983⁷.
 Quinoxaline, 1-benzoyl-1,2,3,4-tetrahydro-2,3-dimethyl-, 1653^{8,9}.
 Seneciophenone, *o*-hydroxy-, phenylhydrazone, 2126⁴.
 C₁₇H₁₅N₂O₅ Carbonic acid, dithiol, Et phenacyl ester, phenylhydrazone, 391⁸.
 Carbonic acid, dithiol-, Me *p*-methylphenacyl ester, phenylhydrazone, 391⁸.
 C₁₇H₁₅N₂O₂ *p*-Anisidine, *N*, *N'*-methylacetylenebis-, 1073¹.
 Δ^3 -2-Butenone, 4-(3-hydroxy-*p*-anisyl)-, phenylhydrazone, 1449⁸.
 C₁₇H₁₅N₂O₃ Benzoic acid, *p*-(3-amino-4-methylbenzamido)-, Et ester, and -HCl, 1451⁸.
o-Benzotoluide, 5'-isopropyl-3'-nitro-, 903⁸.
 Piperidine, 1-(4-nitro-3-phenoxyphenyl)-, 2673⁹.
 C₁₇H₁₅N₂O₄ *o*-Veratric acid, 6(hydroxymethyl)-, benzalhydrazone, 3357⁸.
 C₁₇H₁₅N₂O Acetophenone, carbohydrazone, 1248⁸.
 C₁₇H₁₅N₂O₂ Propene, 1,2-bis(*p*-anisylazo)-, 1972⁹.
 C₁₇H₁₅N₂O₅ Carbanilide, *p*, *p'*-diacetamidothio-, 1637⁹.
 C₁₇H₁₅N₂O₄ Benzaldehyde, 4(*N*-carboxy-anilino)semicarbazone, 69².
 C₁₇H₁₅N₂O₄ Piperidine, 1(5-anilino-2,4-diminothiophenyl)-, 2681⁴.
 C₁₇H₁₅N₂O₇ 7,8-Benzooheptamethylenimine, picrate, 2696².
 C₁₇H₁₅N₂O₈ Allylethylhydroxyphenylammonium picrate, 65⁸.
 C₁₇H₁₅N₃ 1,3,4-Triazole, 2-(methylmercapto)-5-*p*-toluino-1 *p* tolyl-, 2900⁸.
 C₁₇H₁₅N₃S₂ 1,4-Tetrazinedicarboxamide, 2-amino-5-anilindithio-*N*¹-*o*-tolyl-, 2901⁴.
 1,4-Tetrazinedicarboxamide, 2-amino-*N*¹ phenyldithio-5-*o*-toluino(?), 2901⁴.
 1,4-Tetrazinedicarboxamide, 2-anilino-dithio-5-*o*-toluino(?), 2901⁴.
 1,4-Tetrazinedicarboxamide, 2,5-diamino-*N*¹-phenyldithio-*N*⁴-*o*-tolyl-, 2901⁴.
 C₁₇H₁₅O Butyrophenone, α -methyl- α -phenyl-, 1626⁹.
 Isovalerophenone, α phenyl-, 1626⁹.
 3-Pentanone, 1,5-diphenyl-, 1974⁸, 3042¹.
 C₁₇H₁₅O₂ Benzophenone, 4-hydroxy-5-isopropyl-2-methyl-, 1456¹, 1974⁸.
 C₁₇H₁₅O₄ Codeone, tetrahydrohydroxy-, 2698⁸.
 Cyclohexanecarboxylic acid, mixed anhydride with β -benzoylacrylic acid, 2259².
 Santenin, acetyl-, 2476⁴.
p-Toluic acid, 3-methoxy-2-*p*-methoxybenzyl-, 3194².
 C₁₇H₁₅O₃ *o*-Veratric acid, 6-(2-hydroxy-3-methylbenzyl)-, 3357².
o-Veratric acid, methoxybenzyl-, 3357².
 —, 6-vanillyl-, 3357².
 C₁₇H₁₅O₃ Quinide, acetonebenzoyl-, 2701¹.
o-Veratric acid, 6-(2-hydroxy-*m*-anisyl)-, 910².
 C₁₇H₁₅O₄ Δ^3 -Cyclohexene- Δ^1 - β -propionic acid,

- $\alpha, 5$ - diacetyl - 5 - carboxy - 2,6 - diketo-, Et Me ester, 1266^{1,2}.
C₁₇H₁₅Br₂NO₂ Pseudocumenol, 3,6-dibromo- α -(dimethylaminohydroxyphenyl)-, 903².
C₁₇H₁₅I₂NO₂ 3 - Indolepropionic acid, 2-carboxy - 4,6 - diido - 5 - methoxy-, di-Et ester, 90².
C₁₇H₁₅N 2,3-Benzacridine, 1,2,3,4,7,8,9,10-octahydro-, 1123².
C₁₇H₁₅NO Benzamide, *N*-(γ -*p*-tolylpropyl)-, 1461¹.
C₁₇H₁₅NO₂ Benzamide, *N*-[α -(α -hydroxyisopropyl)benzyl]-, 568².
 Benzophenone, 4 - hydroxy-5-isopropyl-2-methyl-, oxime, 1974⁶.
 Cinchophen, 1',2',3',4',5',6' - hexahydro-, Me ester, 915¹.
 Phenol, *p*-(γ -aminobutyl)-, benzoate, and -HCl, 1449⁷.
 α - Toluamide, *N* - (β - methoxyphenethyl)-, 1462¹.
C₁₇H₁₅NO₂S 7,8 - Benzoheptamethylenimine, benzenesulfonyl-, 2699².
 α -Homotetrahydroisquinoline, benzene-sulfonyl-8-methyl-, 1461¹.
C₁₇H₁₅NO₂ See *Morphine*; *Pipirine*.
C₁₇H₁₅NO₂ Laudanosoline, -H₂SO₄, 1989⁹.
C₁₇H₁₅NO₂S Benzoic acid, *m*-(benzylsulfamyl)-, Pr ester, 3604⁵.
 Glycine, *N* - (*p* - methylphenethyl)- *N*-(phenylsulfonyl)-, 1460⁹.
C₁₇H₁₅NO₂S 4 Ethoxy - 10 - methylacridinium methosulfate, 1461².
C₁₇H₁₅NO₆ Malonic acid, (2 carboxy-3-indylmethyl)-, di-Et ester, 583².
C₁₇H₁₅N₂O₂ Acridine, 2,8-diamino 3,7-diehoxy-, P 593².
C₁₇H₁₅N₂S Benzothiazole, 5 dimethylamino-1-(β dimethylaminophenyl)-, 1985².
C₁₇H₁₅N₂O Hydrocinnamamide, α -amino-*N*-ethyl-, picrate, 378¹.
C₁₇H₁₅N₂O₂ Trimethyl(nitrophenethyl)ammonium picrate, 1250⁶.
C₁₇H₁₅N₂O₂ Glutaconic acid, α, γ -dicarbamyl-, di Et ester, picrate, 1248².
C₁₇H₁₅Br₂N₂O Pseudocumenol, α -(aminodimethylaminophenyl) - 3,6 - dibromo-, 903².
C₁₇H₁₅Br₂N₂S β - Naphthothiazole, 2 hexylamino, tetrabromide, -HBr, 581².
C₁₇H₁₅I₂O₂ See *Bornjosal*.
C₁₇H₁₅N₂ 2-Butanone, 4-phenyl, *p*-tolyl hydrazone, 69¹.
 Imidazole, tetrahydro - 4,5 - dimethyl-1,3-diphenyl-, 1810².
 Quinazoline, 5,6,7,8 - tetrahydro-1,7(and 4,8)-dimethyl-2-*p*-tolyl-, 3198^{2,7}.
C₁₇H₁₅N₂O Benzophenone, *p, p'*-bis(dimethylamino), salts, 403².
 Benzylamine, *N*-butyl-*p*-nitroso-*N*-phenyl-, and -HCl, 2884⁴.
 Hydrocinnamamide, α -amino - *N* - phenethyl-, and -HCl, 1658¹.
 Isobutyrophenone, 2-hydroxy - 5 - methyl-, phenylhydrazone, 1117².
 Salicylaldehyde, 5 - *tert* - butyl, phenyl hydrazone, 69¹.
C₁₇H₁₅N₂OS See *Thioflavin*.
C₁₇H₁₅N₂O₂ Acetamide, α -amino-*N*-(β -hydroxy- β, β - diphenylisopropyl)-, 568².
C₁₇H₁₅N₂O₂S Carbanilide, 2,2'-(and 3,3')-diethoxythio-, 1637².
 Quinoxaline, 1,2,3,4 - tetrahydro-2,3-dimethyl-1-*p*-tolylsulfonyl-, 1653^{2,8}.
C₁₇H₁₅N₂O₂S Carbanilide, 2,5,2',5'-(and 3,4,3',4')-tetramethoxythio-, 1637².
C₁₇H₁₅N₂S Carbanilide, tetramethylthio-, 671², 1637².
 β -Naphthothiazole, 2-hexylamino-, 544².
 Urea, α - phenylthio - β - (γ -*p*-tolylpropyl)-, 1461¹.
C₁₇H₁₅N₂O 2-Butanone, 4-phenyl, 4-aurilino-semicarbazone, 689².
C₁₇H₁₅N₂O₂ Benzaldehyde, β - dimethylamino-, β - ethyl - β - (*p* - nitrophenyl)hydrazone, 1251⁴.
 Pyruvaldehyde, *p*-anisylsulfonate, 1973².
C₁₇H₁₅N₂O₂ 2 Naphthylamine, *N*-heptyl-1,6,8-trinitro-, 104².
C₁₇H₁₅N₂O₂ Ethylhydroxyphenylpropylammonium picrate, 637².
C₁₇H₁₅N₂O₂ Guanidine, α, α' propylenebis-, dipicrate, 631².
 Guanidine, α, α' - trimethylenebis-, di picrate, 631².
C₁₇H₁₅O Camphor, 3-benzal-, 86².
C₁₇H₁₅O₂ Capric acid, β -benzoyl- γ -hydroxy- α keto-, lactone, 3900⁶.
 2-Indanol, hexahydro, acid phthalate, 1112², 1113¹.
C₁₇H₁₅O₂ Malonic acid, α -(hydroxyphenylmethyl)benzyl, lactone, Me ester, 894⁴.
C₁₇H₁₅O₂ 1-Benzofuraminalonic acid, 1,2-dihydro 2 keto-1,4-dimethyl, di-Et ester, 911².
C₁₇H₁₅ClN₂O₂ Benzohydrol, *p, p'*-bis(dimethylamino), perchlorate, and ZnCl₂ compd., 1110⁷.
C₁₇H₁₅N Benzylamine, *N*-butyl *N*-phenyl, 1800², and chloroplatinate, 2884⁴.
C₁₇H₁₅NO *p* Cresol, α (*N*-butylanilino), 1800².
C₁₇H₁₅NO₂ β, δ -Hexadienic acid, α -(amyl imino) *c*-phenyl, 2882².
 Phenethylamine, 4 - benzyloxy - 3 - methoxy-*N*-methyl, 96².
C₁₇H₁₅NO₂S α - Toluenesulfonanilide, *N*-butyl-, 99².
C₁₇H₁₅NO₂S *p*-Toluenesulfonic acid, α -(*N*-butylanilino)-, and Ba salt, 1800².
C₁₇H₁₅NO₂ (See also Cocaine; *Hvosrine*; *Scopolamine*.)
 Apoptropine, *N*-oxide, and -HCl, 384⁴.
 Camphene, hydrate, *p*-nitrobenzoate, 2890².
 4a,9a - Carbazole, 9 acetyl-1,2,3,4-tetrahydro 6-methyl-, monoacetate, 91².
 Isoborneol, *p*-nitrobenzoate, 2890².
 Pseudococaine, 2901².
C₁₇H₁₅NO₂ Scopolinium tropate, 3365².
 Scopolamine, *N*-oxide, and salts, 384⁴.
C₁₇H₁₅NO₂S Apoptropine, *N* sulfonated ether, 381⁴.
C₁₇H₁₅NO₁₀ Malonic acid, (3,4,5-trimethoxy-2-nitrobenzoyl), di Et ester, 912¹.
C₁₇H₁₅N₂ Guanidine, dixyl-, 672^{2,4}, P 3768⁶.
C₁₇H₁₅N₂O₂S *S*-Phenylthiosulfuric acid, 5-dimethylamino - 2 - (*p* - dimethylaminobenzalmino)-, 1985².
C₁₇H₁₅ClN₂ See *Auramine*.
C₁₇H₁₅ClP Benzyl-diethylphenylphosphonium chloride, 66².
C₁₇H₁₅IP Sekisanine, methiodide, 3622².
C₁₇H₁₅IP Ethyldiphenylpropylphosphonium iodide, 66².
C₁₇H₁₅N₂ Phenethylamine, *p*-phenethylamino-methyl-, and salts, 566².
 β -Phenylenediamine, *N*-benzyl-*N*-butyl-, and salts, 2884⁴.
C₁₇H₁₅N₂O₂ Camphor, oxime, carbanilate, 1628².

- 5 - Isopyrrolecarboxylic acid, 3,5-dimethyl-2-(3,4,5-trimethyl-2-pyrrylmethylene)-, Et ester, and salts, 85¹.
+ 2H₂O, Yohimbenic acid, 413⁸.
- C₁₇H₂₇N₂O₂ Menthone, oxime, *p*-nitrobenzoyl deriv., 2389⁹.
- C₁₇H₂₇N₂O₃ 1-Butanesulfonic acid, 1-phenylcarbamyl-, PhNH₂ salt, and salts, 3601².
- C₁₇H₂₇N₂O₄ α-Glucoheptose, 2-naphthylhydrazone, 2879⁸.
Nipecotic acid, 1-(γ-hydroxypropyl)-, Me ester, *p*-nitrobenzoate, -HCl, 1977⁸.
- C₁₇H₂₇N₂S Urea, α-hexyl-β-1-naphthylthio-, 584⁹.
- C₁₇H₂₇N₂O₃ Bicarbamie acid, *N,N'*-(2-propenyl-*m*-phenylene)bis-, tetra-Me ester, 1124¹.
- C₁₇H₂₇N₂S Carbanilide, bis(ethylamino)thio-, 671⁸.
- C₁₇H₂₇O₂ Borneol, benzoate, 2682⁴.
Endoborneol, benzoate, 3612⁸.
Isoborneol, benzoate, 2882⁴.
2-Naphthol, decahydro-, benzoate, 1112^{4,5}.
- C₁₇H₂₇O₃ Artemisic acid, dihydro-, Et ester, 1126⁷.
Cyclohexanepropionic acid, 2-keto-β-phenyl-, Et ester, 231⁴.
- C₁₇H₂₇O₂ Spiro[cyclohexane-1,1'-cyclopropane-2,1'-cyclohexane]-2,6,2'',6''-tetrone, 4,4,4'',4''-tetramethyl-, 3203⁸.
- C₁₇H₂₇O₃ Malonic acid, [α-(α-formylisopropyl)-benzyl]methyl-, di-Me ester, 3044⁴.
Malonic acid, α-pivalylmethylbenzyl-, mono-Me ester, 894¹.
- C₁₇H₂₇O₂ Δ¹-5,6 - Spirodecene - 1,2,4 - tricarboxylic acid, 3-keto-4-methyl-, Et Me ester, 3187⁹.
- C₁₇H₂₇BrO₁₁ Glucoheptose, β-acetobromo-α-, 2252¹.
- C₁₇H₂₇NO Benzamide, *N*-(decahydro-2-naphthyl)-, 1112^{6,7}.
Δ¹,α - Cyclohexaneceto - *p* - toluid, α-ethyl-, 3187².
Δ¹ - Cyclohexaneceto - *p* - toluid, α-ethyl-, 3187¹.
- C₁₇H₂₇NO₂ Cinchophen, 1,2,3,4,10,9',3',4',-5',6'-decahydro-, Me ester, 915^{1,4}.
Endoborneol, carbanilate, 3612⁸.
Homocamphenilol, carbanilate, 2891⁴.
2-Naphthol, decahydro-, carbanilate, 1112^{4,5}.
Piperidinol, allyldimethyl-, benzoate, P 1523¹.
- C₁₇H₂₇NO₃ (See also *Atropine*; *Hyoscyamine*.)
1,3 - Cyclohexanedione, 2-[(2-amino-6-keto-4,4-dimethyl-Δ¹-cyclohexenyl)-methylene]-5,5-dimethyl-, 2872⁸.
- C₁₇H₂₇NO₄ Atropine, *N*-oxide, and -HCl, 384⁴.
Hyoscyamine, Λ oxide, and -HCl, 384⁴.
- C₁₇H₂₇NO₄S Isoamylsulfuric acid, PhNH salt, 53².
- C₁₇H₂₇NO₃S Atropine, *N*-sulfonated ether, 384⁴.
Hyoscyamine, *N*-sulfonated ether, 384⁴.
- C₁₇H₂₇N₂ Guanidine bis(dimethylaminophenyl)-, 672⁴.
- C₁₇H₂₇N₂O₄ Arginine, *N*α - (α-acetamidocinnamyl)-, 2876⁹.
- C₁₇H₂₇Hg₂N₂O Compd., m. 156°, from caryophyllene, 237¹.
- C₁₇H₂₇IN₂ Diphenylamine, *p,p'*-bis(dimethylamino)-, methiodide, 2670⁷.
- C₁₇H₂₇N₂ Isopyrrole, 4-ethyl-2-[(4-ethyl-3,5-dimethyl-2-pyrryl)methylene]-3,5-dimethyl-, and arsenate, 2701⁹.
- C₁₇H₂₇N₂O₄ Butyric acid, α-(cyclohexylnitrosoamino)-γ-phenyl-, 2882⁷.
Hydrazine, α,α-diacetyl-β-cyclohexyl-β-otolyl-, 1102⁹.
- C₁₇H₂₇N₂O₃ Butyric acid, (cyclohexylnitrosoamino)phenyl-, methyl ester, 2876⁴.
- C₁₇H₂₇N₂O₄ Benzoic acid, *p*-nitro-, *o*-diethylaminocyclohexyl ester, -HCl, 1977⁸.
Nipecotic acid, 1-(γ-hydroxypropyl)-Me ester, *p*-aminobenzoate, -HCl, 1977⁸.
- C₁₇H₂₇N₂O₃S Isoamylsulfuric acid, benzidine salt, 53².
- C₁₇H₂₇N₂O₃S Valeric acid, α-sulfo-, PhNH₂ salts, 3600⁹.
- C₁₇H₂₇N₂O₃ 1 - Piperidineethanol, β-(γ,δ-epoxybutyl)-, picrate, 50⁹.
- C₁₇H₂₇O₂ Veratrole, 3-(β-methyl-Δ^{1,4}-penta-2,5-dienyl)-5-propyl-, 72².
- C₁₇H₂₇O₃ Decenone, 1-(4-hydroxy-*m*-anisyl)-, 1975⁸, 2258², 3623⁷.
Shogaol, 1975⁷, 2258², 3359¹.
- C₁₇H₂₇O₄ 1,3-Cyclohexanedione, 2,2'-methylenebis[5,5'-dimethyl-, 3202⁹.
- C₁₇H₂₇O₃ 3,6 - Spirooctane-1-valeric acid, δ,3,7-triketo - β,β,5,5 - tetramethyl-, 3203⁸.
- C₁₇H₂₇N 3-*p*-Menthylamine, *N*-benzal-, 794^{4,5,7,8}.
- C₁₇H₂₇NO Benzamide, *N*-menthyl-, 794^{4,5,7,8}.
α-Cresol, α-menthylimino -, 794^{4,5,7,8}, 2889⁹.
- C₁₇H₂₇N₂O₃ Benzoic acid, *p*-amino-, menthyl ester, and salts, 907⁹.
Butyric acid, cyclohexylaminophenyl-, methyl ester, and -HCl, 2876⁴, 2882⁷.
Menthyl, carbanilate, 400⁴, 1806⁴.
2-Naphthylamine, decahydro-, benzoate, 1112^{4,5}.
- Hexenic acid, α-(amylamino)-*ε*-phenyl-, 2883¹.
- C₁₇H₂₇NO₄ Benzoic acid, *p*-nitro-, decyl ester, 2658⁹.
Ethanol, 2 - [β - (β - dimethylaminoethoxy)-ethoxy]-, cinnamate, 3880⁴.
- C₁₇H₂₇N₂O₃ Arginine, *N*α - (N - acetyl-β-phenylalanyl)-, 2876⁹.
- C₁₇H₂₇Hg₂O₃ Undecylic acid, α-tris(acetoxymercuri)-α-keto-, Hg salt, 3348⁸.
- C₁₇H₂₇N₂ Isoquinoline, 1,2,3,4-tetrahydro-2-(γ - 1 - piperidylpropyl)-, and salts, 1653^{2,3}.
- C₁₇H₂₇N₂O Urea, α-menthyl-β-phenyl-, 794^{4,5,7,8}, 1806⁴.
- C₁₇H₂₇N₂O₂ Benzoic acid, *p*-amino-, diethylaminocyclohexyl ester, 1977⁸.
- C₁₇H₂₇N₂O₃ Urea, α-menthyl-β-phenylthio-, 794^{4,5,7,8}.
- C₁₇H₂₇O Ether, benzyl menthyl, 737⁹.
- C₁₇H₂₇N₂O Benzoic acid, decyl ester, 2658⁹.
Caprylophenone, 4 - hydroxy - 3 - propyl-, 1974⁷.
Cyclohexanol, 4 - (4 - hydroxy - α,α,3-trimethylbenzyl)-2-methyl-, P 2273⁷.
- C₁₇H₂₇O₂ 3-Decanone, 1-(4-hydroxy-*m*-anisyl)-, 3623⁷.
3-Nonanone, 1 - (3,4 - dimethoxyphenyl)-, 3623⁷.
- C₁₇H₂₇N Cyclohexylamine, *N*-*ε*-phenylamyl-, and -HCl, 2883¹.
- C₁₇H₂₇NO Undecylamide, 2873⁷.
- C₁₇H₂₇NO₂ Benzoic acid, *p*-amino-, decyl ester, -HCl, 2658⁹.
Caproic acid, α-(amylamino)-*ε*-phenyl-, 2883¹.
Carbanilic acid, decyl ester, 2658⁹.

- 1-Pentanol, 2-(α - aminoethyl)-2-propyl-, benzoate, -HCl, 3347⁴.
- C₁₇H₂₇N₃O₃ 3-Nonanone, 1-(3,4-dimethoxyphenyl)-, oxime, 3623⁷.
- C₁₇H₂₇N₃O₃ 3,4-Pyrroledicarboxylic acid, 1-isoamyl-2,5-dimethyl-, di-Et ester, 243⁴.
- C₁₇H₂₇N₃O₃ Undecylic acid, phenylsulfonamido-, 258⁹.
- C₁₇H₂₇N₃O₃ Isocaproamide, *N*-ethyl- α -propylamino-, picrate, 1657⁹.
- Propionamide, *N*-isoamyl- α -propylamino-, picrate, 1657⁹.
- C₁₇H₂₇N₃ 1,7-Heptanediamine, *N*-(1,2,3,4-tetrahydro-2-naphthyl)-, and salts, 566⁷.
- Piperidine, 1-(α -benzylaminoamyl)-, 409⁹.
- C₁₇H₂₇N₃O Urea, α -decyl- β -phenyl-, 2658⁹.
- C₁₇H₂₇O₃ Ngaiol, dihydro-, acetate, 2263⁹.
- C₁₇H₂₇Br₂N₃O₂ Compd., m. 134.5°, from caryophyllene, 237¹.
- C₁₇H₂₇ClNO₂ Compd., m. 137°, from caryophyllene, 237¹.
- C₁₇H₂₇N₃ Thapsionitrile, γ -methyl-, 3350⁴.
- C₁₇H₂₇N₃O₂ Matric acid, methyl-, Me ester, 2135⁷.
- C₁₇H₂₇N₃O₇ Leucine, carbonylbis[glycyl-, 3200².
- C₁₇H₂₇O₂ Civetone, 3707³, 3708¹.
- C₁₇H₂₇O₃ Ngaiol, tetrahydro-, acetate, 2264¹.
- Δ^1 - 1,5 - Pentenedicarboxylic acid, 2-isoamyl-3-methyl-, di-Et ester, 578².
- C₁₇H₂₇O₇ Glucoheptoside, β -borneol- α -, 2252².
- Glucoheptoside, β -geraniol- α -, 2252¹.
- C₁₇H₂₇Sn Stannane, benzylidibutylethyl-, 904⁵.
- C₁₇H₂₇ Pentane, 1,5-dicyclohexyl-, 1974⁹.
- C₁₇H₂₇N₃O 4-Heptanone, 1,7-di-1-piperidyl-, 2271¹.
- C₁₇H₂₇N₃O₈ Pseudothiohydantoin, 5-tetradecyl-, 3045⁹.
- C₁₇H₂₇O₂ Cyclohexanol, 4,4'-isopropylidenebis[2-methyl-, P 2273⁸.
- Pentadecenic acid, ethyl ester, 2874^{1,2}.
- γ -Pentadecenic acid, γ -methyl-, methyl ester, 2874².
- C₁₇H₂₇O₂ Brassylic acid, di-Et ester, 391¹.
- 1,12-Dodecanedicarboxylic acid, 2-methyl-, di-Me ester, 3349⁸.
- Pimelic acid, β -isoamyl- γ -methyl-, di-Et ester, 578².
- Thapsic acid, methyl-, 3350^{3,4}.
- C₁₇H₂₇N₃O Muscone, semicarbazone, 571⁹.
- C₁₇H₂₇N₃O₄ Azelaic acid, α , γ -bis(dimethylamino)-, di Et ester, 59⁸.
- Glutaric acid, α , γ -bis(diethylamino)-, di Et ester, 60⁸.
- C₁₇H₂₇O₂ Daturic acid, 660⁹, 1891⁵.
- Palmitic acid, α -methyl-, 2250¹.
- C₁₇H₂₇O₂ Juniperic acid, α -methyl-, 3350⁹.
- C₁₇H₂₇N₃ 1,1' - Pentamethylenebis[1-methylpiperidinium diiodide, 409⁹.
- C₁₇H₂₇N₃O Isocaproamide, *N*-ethyl- α -nonylamino-, 1657⁹.
- C₁₇H₂₇N₃ 1,6-Hexanediamine, *N*- Δ^3 -hexenyl-, *N*, *N'*-trimethyl-, dimethiodide, 3186⁴.
- C₁₇Fe₂N₁₂ See *Iron ferrocyanide; Prussian blue*.
- C₁₇H₂₇BrN₃O₂ 3-Pyranquinolone, 2-bromo-, picrate, 382⁹.
- C₁₇H₂₇Br₂O₂ Truxone, dibromo-, 1636².
- C₁₇H₂₇ClN₃O₄ 2,1,3 - Benzotriazol-4(7) - one, 6-chloro - 5 - hydroxy - 2 - (p - nitrophenyl)-7-phenylimino-, 2689⁷.
- C₁₇H₂₇CuN₃O₂ 1,2,4-Oxiazolol, benzoyl-, Cu deriv., 2403^{4,5}.
- C₁₇H₂₇N₃O₄ Naphthalic anhydride, 3-hydroxy-4-phenylazo-, 2683⁷.
- C₁₇H₂₇O₂ Δ^1 , Δ^2 -Bi[indan]-3,1',3'-trione, 3202⁷.
- C₁₇H₂₇BrN₃O₂ Ether, 4-(4-bromo-2-nitrophenyl)-2-nitrophenyl phenyl, 379⁷.
- C₁₇H₂₇BrO₂ Quinizarin 2-bromo-, diacetate, 3192¹.
- C₁₇H₂₇ClN₃O₂ Ether, 4-(4-chloro-2-nitrophenyl)-2-nitrophenyl phenyl, 379⁷.
- C₁₇H₂₇N Acenaphthindole, 1262⁹.
- C₁₇H₂₇NO₂ Fluorene, 9-(2-fural)-2-nitro-, 3362⁹.
- C₁₇H₂₇N₂ 2,3-Benzo-5,6-acenaphtho-1,4,7-heptatriazine, 2132⁷.
- C₁₇H₂₇N₃O₂ Acenaphthenequinone, mono-*o*-nitrophenylhydrazone, 2133².
- C₁₇H₂₇N₃O₂ 1,2,3-Benzotriazole, 1-(3-carbazyl)-5-nitro-, 3198⁹.
- C₁₇H₂₇N₃O₂ 2,1,3-Benzotriazole, 2-phenyl 5-(2,4,6-trinitroanilino), 2130¹.
- C₁₇H₂₇ (See also *Truxene*.)
- Chrysene, 1649⁵.
- C₁₇H₂₇As₂N₂ Isoquinoline, arsenobis-, 2695⁹.
- Quinoline, 5,5'(6,6' and 8,8')-arsenobis-, di-HCl, 2695^{7,8}.
- C₁₇H₂₇As₂N₂O₂ Carbostyryl, 6,6'-arsenobis, 2695⁷.
- C₁₇H₂₇BrN₃O₄ Xenylamine, 4'-bromo-2,2'-dinitro-*N*-phenyl-, 379⁷.
- C₁₇H₂₇Br₂O₂ 9,10-Phenanthrenediol, 2,7-dibromo-, diacetate, 2895⁴.
- C₁₇H₂₇Br₂N₃O₂ Δ^2 - 3 - Pyrazolinedicarboxylic acid, 1 - (2,4 - dibromophenyl)-4,5-diketo-, ethyl ester, 4-(2,4-dibromophenyl)hydrazone, 2899⁹.
- C₁₇H₂₇ClNO₂ 1,2-Benzacridine - 7 - carboxylic acid, 2-chloro-5,6-dihydro-, 1123⁹.
- 10 - Indeno[3,2-*b*]quinolinedicarboxylic acid, 8-chloro-11-methyl-, 1123⁹.
- C₁₇H₂₇ClN₃O₄ Xenylamine, 4'-chloro-2,2'-dinitro-*N*-phenyl-, 379⁷.
- C₁₇H₂₇Cl₂N₃O₄ Δ^2 - 3 - Pyrazolinedicarboxylic acid, 1-(2,4 - dichlorophenyl)-4,5-diketo-, ethyl ester, 4-(2,4 - dichlorophenyl)hydrazone, 2899⁹.
- C₁₇H₂₇FeN₃O₁₀ Hydroxylamine, nitrophenylnitroso-, ferric deriv., 3048⁹.
- C₁₇H₂₇N₃ 1,2-Benzacridine - 8 - nitrile, 5,6-dihydro-, 1122⁷.
- C₁₇H₂₇N₃O₂ 1,2 - Renzacridine-7-carboxamide, 2122².
- C₁₇H₂₇N₃O₂ Phthalimide, *N*-(7-amino-2-naphthyl)-, 2892¹.
- C₁₇H₂₇N₃S₄ Disulfide, bis(thiono-3-indolecarboxyl)-, 1460¹.
- C₁₇H₂₇N₃O₄ Carbazole, 3-(2,4-dinitroanilino)-, 3198⁹.
- C₁₇H₂₇N₃O₈ Furo[3,2-*f*]quinoline, 7-methyl-, picrate, 382⁹.
- Indigotin, dimethoxydinitro-, 2675^{7,8}.
- C₁₇H₂₇N₃ 1,2,3 - Benzotriazole, 1,1'-*p*-phenylenebis-, 3199¹.
- C₁₇H₂₇N₃O₂ Benzotriazole, (2,4-dinitroanilino)-phenyl-, 2130¹, 3199².
- C₁₇H₂₇N₃O₄ 2,2'-Biimidazole, dipicrate, 3364².
- C₁₇H₂₇O₂ Truxone, 1635⁹, 2081⁷.
- C₁₇H₂₇O₂ Quinone, 2,5-diphenoxy-, 3605⁹.
- C₁₇H₂₇O₂ Coumarin, 3-benzoyl-7-hydroxy-, acetate, 378².
- 1,4-Pyrone, 5-benzoyl - 2 - (2,4 - dihydroxyphenyl)-, 1265⁷.
- C₁₇H₂₇O₂ Piperonylic acid, mixed anhydride with β -benzoylacrylic acid, 2259³.
- Quinone, 2,5 - bis(2,4 - dihydroxyphenyl)-, 2887^{7,8}.
- C₁₇H₂₇O₂ Pyromellitic anhydride, *p*-dimethoxybenzene addn. compd., 1455⁴.

- C₁₈H₁₂O₈P₂ 0-Phenylene phosphate, 24617.
 C₁₈H₁₂AsO Phenoxarsine, 6-phenyl-, 16541.
 C₁₈H₁₂AsO₂ 6-Phenylphenoxarsonium oxide, 16541.
 C₁₈H₁₂Br Naphthalene, 1-[α-(bromomethylene)-benzyl]-, 9094.
 C₁₈H₁₂Br₂NOS₂ Disulfide, 4-acetamido-1-naphthyl 2,5-dibromophenyl-, 2348.
 C₁₈H₁₂ClN₂O 3-Acenaphthenol, 4-chloro-2-phenylazo-, 26838.
 C₁₈H₁₂ClN₂O₂S Anilide, m. 188°, 33554.
 C₁₈H₁₂ClO 2,1-Indenoindene, 10-chloro-5-ethoxy-, 841.
 C₁₈H₁₂NO₂ 1,2-Benzacridine-8-carboxylic acid, 5,6-dihydro-, 11228.
 10-Indeno[3,2-β]quinolinicarboxylic acid, 11-methyl-, 11238.
 2-Pyranobenzoquinolone, 4,7-dimethyl-, and salts, 4112.
 C₁₈H₁₂NO₂ 1,2-Benzacridine-7-carboxylic acid, 5,6-dihydro-2-hydroxy-, 11238.
 C₁₈H₁₂NO₂ Isoquinoline, 6,7-methylenedioxy-1-piperonyl-, 14623.
 3-Quinoloneacetic acid, 4-carboxy-2-phenyl-, 26958.
 C₁₈H₁₂N₂O (See also *Rutecarpine*.)
 1,2,4-Triazol-5-ol, 1-(1-naphthyl)-3-phenyl-, 7433.
 C₁₈H₁₂N₂O₂ Benzoxylide, dinitro-, 26708.
 C₁₈H₁₂N₂ 1,2,3-Benzotriazole, 5-amino-1-(3-carbazyl)-, 31989.
 C₁₈H₁₂N₂O 1,2,3-Benzotriazol-5-ol, 1-phenyl-1-phenylazo-, 39044.
 C₁₈H₁₂N₂O₂ Ketone, *p*-aminophenyl 1-pyridyl, monopicrate, 944.
 C₁₈H₁₂O₂P Phenyl di-*o*-phenylene orthophosphate, 30572.
 C₁₈H₁₄ Naphthalene, 1-(α-methylenebenzyl)-, 9092.
 Terphenyl, 16434, 24701.
 C₁₈H₁₄AsN Phenarsazine, 1,6-dihydro-1-phenyl-, 16541.
 C₁₈H₁₄BeCl₂N₂ Addn. compd. from quinoline and BeCl₂, 16018.
 C₁₈H₁₄BrN₂O Acetamide, *N*-[4-(*o*-bromophenylazo)-1-naphthyl]-, 11142.
 C₁₈H₁₄BrN₂O₂ Δ²-3-Pyrazolinecarboxylic acid, 1-(*p*-bromophenyl)-4,5-diketo-, ethyl ester, 4-*p*-bromophenylhydrazone, 28998.
 C₁₈H₁₄ClNO₂ Creosol, 6-chloro-α-(2-naphthyl-imino)-, 9068.
 C₁₈H₁₄ClN₂O Acetamide, *N*-[(*o*-chlorophenylazo)-1-naphthyl]-, 11138.
 C₁₈H₁₄Cl₂N₂Pt, 28561.
 C₁₈H₁₄Cl₂N₂O₂ Δ²-3-Pyrazolinecarboxylic acid, 1-(*p*-chlorophenyl)-4,5-diketo-, ethyl ester, 4-*p*-chlorophenylhydrazone, 28998.
 C₁₈H₁₄Cl₂O₂ 9-Anthracenecarbinol, 1,5-dichloro-α-methyl-, acetate, 12613.
 C₁₈H₁₄I₂N₂O₄ Piperazinedione, bis(hydroxy-diiodobenzyl)-, 14897, 22608.
 C₁₈H₁₄N₂O 8-Benzophenazine, 5-ethoxy-, 839.
 Glyoxal, 1(and 2)-naphthylphenyl-, monohydrazone, 18114.
 Phenol, 4-phenyl-2-phenylazo-, 11098.
 Triphenylamine, *p*-nitroso-, 991.
 C₁₈H₁₄N₂O₂ 1,2-Benzacridine-7-carboxylic acid, 2-amino-5,6-dihydro-, and di-HCl, 11238.
 Glyoxylamide, *N*-(5,6,7,8-tetrahydronaphthyl)-, oxime, 11228, 11232.
 5-γ-Isobenzophenoxazin-δ-one, 9-dimethylamino-, 7439.
 C₁₈H₁₄N₂O₂ 1-Imidazoleacetic acid, 4-benzal-4,5-dihydro-5-keto-2-phenyl-, and *Na* salt, 18134.
 C₁₈H₁₄N₂O₂S₂ *m*-Benzenedisulfonanilide, 4,5-dihydroxy-, sulfate, 728.
 C₁₈H₁₄N₂ Isopyrrole, 2,2'-(di-2-pyrrolyl-ene)bis-, 12617.
 C₁₈H₁₄N₂O Benzisoxazole, 4-(2-amino-1-naphthylazo)-2-methyl-, 33637.
 C₁₈H₁₄N₂O₂ Carbazole, 3-(2-amino-4-nitro-anilino)-, 31988.
 Ketone, *p*-nitrophenyl pyridyl, phenylhydrazone, 938, 943.
 C₁₈H₁₄N₂O₂ *p*-Phenylenediamine, *N*, *N*'-bis-(*o*-nitrophenyl)-, 31991.
 C₁₈H₁₄N₂O₂ 2-Naphthylamine, *N*-ethyl-1,6,8-trinitro-*N*-phenyl-, 4048.
 --, *N*-(α-methylbenzyl) 1,6,8-trinitro-, 4048.
 --, 1,6,8-trinitro-*N*-phenethyl-, 4048.
 C₁₈H₁₄N₂O₁₀ 3-Furancarboxylic acid, 2-(2-pyridyl)-, Et ester, picrate, 4068.
 Phthalide, 6,6'-hydrazobis[5-methoxy-3-nitro-, 33581.
 C₁₈H₁₄N₂ 1,2,3-Benzotriazole, 5-amino-1-phenyl-4-phenylazo-, 26909.
 C₁₈H₁₄O₂ Ketone, diphenyl-3-thienyl methyl-, 39038.
 C₁₈H₁₄O₂ 2,2'-Spiro[1,2-benzopyran], 3-methyl-, 4079, 29008, 31969.
 C₁₈H₁₄O₂ Flavone, 3-acetyl-6-methyl-, 24721.
 3-Furanol, 2,5-diphenyl-, acetate, 828.
 C₁₈H₁₄O₂ 2,3-Anthracenediol, diacetate, 19841.
 Hydroquinone, 2,5-diphenoxy-, 36059.
 2-Indanacetic acid, 1,3-diketo-2-phenyl-, Me ester, 16478.
 Muconic acid, β,γ-diphenyl-, 16328.
 2,2'-Spiro[1,2-benzopyran]-7,7'-diol, 3-methyl-, 31971.
 Toluic acid, mixed anhydride with β-benzoylacrylic acid, 22592.
 C₁₈H₁₄O₂ Aisic acid, mixed anhydride with β-benzoylacrylic acid, 22592.
 C₁₈H₁₄O₂ Anthracenetetrol, diacetate, 28948.
 Hydroquinone, 2,5-bis-(2,4-dihydroxyphenyl)-, 28873.
 C₁₈H₁₄O₂ Hydroquinone, 2,5-bis-(4,1,5-trihydroxyphenyl)-, 28874.
 C₁₈H₁₄AsO₂ 6-Phenylphenoxarsonium dihydroxide, 16541.
 C₁₈H₁₄AsS Arsinic, triphenyl-, sulfide, H₂Cl₂ compd., 9051.
 C₁₈H₁₄Bi Bismuthine, triphenyl-, 14498.
 C₁₈H₁₄Br₂O Germane, bromotriphenyl-, 38969.
 C₁₈H₁₄BrN₂O₂ α-Pentenonitrile, γ-bromo-δ-methoxy-γ-nitro-α,δ-diphenyl-, 2231.
 C₁₈H₁₄Cl₂O Germane, chlorotriphenyl-, 38969.
 C₁₈H₁₄Cl₂O Isobenzophenoxazine, 9-methyl-imino-, methochloride, 7439.
 C₁₈H₁₄ClN₂O₂S Dye from benzophenoxazine-sulfonic acid deriv., 30248.
 C₁₈H₁₄ClO Furan, 3-chloro-2,5-ditolyl-, 828.
 C₁₈H₁₄ClO₂ 2-(*o*-Hydroxystyryl)-3-methylbenzopyrylium chloride, 29008, 31909.
 3-Pentadienone, 1-*o*-anisyl-5-(*p*-chlorophenyl)-, 22589.
 C₁₈H₁₄ClO₂Zr Compd. from PhOH and ZrCl₄, 10694.
 C₁₈H₁₄ClO₂ 2-(2,4-Dihydroxystyryl)-7-hydroxy-3-methylbenzopyrylium chloride, 4088, 31909.

- C₁₈H₁₁ClO₃** 2 - Methyl - 4,6 - diphenylpyrylium perchlorate, 1814².
- C₁₈H₁₁ClO₃** 2 - (o - Hydroxystyryl) - 3 - methylbenzopyrylium perchlorate, 2900⁸.
- C₁₈H₁₁ClO₃** 2 - (2,4 - Dihydroxystyryl)-7-hydroxy - 3 - methylbenzopyrylium perchlorate, 408⁸.
- C₁₈H₁₁Cl₂FeO₃** 2 - (o - Hydroxystyryl) - 3 - methylbenzopyrylium ferric chloride, 2900⁸.
- C₁₈H₁₁FGe** Germane, fluorotriphenyl-, 9047.
- C₁₈H₁₁GeI** Germane, iodotriphenyl-, 9047.
- C₁₈H₁₁GeNa** Germane, triphenyl-, Na deriv., 9047.
- C₁₈H₁₁GeNaO** Germane, hydroxytriphenyl-, Na deriv., 9047.
- C₁₈H₁₁N** Triphenylamine, 1799².
- Xenylamine, N-phenyl-, 67².
- C₁₈H₁₁NO** 1,2 - Benzacridine - 7 - carbinol, 5,6-dihydro-, and *di-HCl*, 1122².
- C₁₈H₁₁NO₂** Cinchophen, 6,8-dimethyl-, 3622².
- , 4'-methyl-, Me ester, 2695⁶.
- Δ²-4 - Cyclopentadienone, 2-hydroxy-5- (N - methylanilino) - 3 - phenyl-, 1106³.
- 3-Quinolinecarboxylic acid, 2-phenyl-, Et ester, 2695⁶.
- C₁₈H₁₁NO₂** Cinchophen, 4' methoxy 6(7 and 8)-methyl-, 3622².
- Δ²-1-Propenol, 3-(2-furyl)-, 1-naphthalene-carbamate, 3053⁷.
- Valeric acid, α-anilino-β-benzoyl-γ-hydroxy-, lactone, 3900⁶.
- C₁₈H₁₁NO₄** α,γ-Pentadienic acid, γ-nitro-α, δ-diphenyl-, Me ester, 223¹.
- C₁₈H₁₁NO₁₀** Protocatechuy alcohol, tris(methyl carbonate), p-nitrobenzoate, 2886⁶.
- C₁₈H₁₁N₂O₂P** Phosphamide, o-phenylene[N - diphenyl]-, 3057¹.
- C₁₈H₁₁N₂** Carbazole, 3-(p-aminoanilino)-, 3199¹.
- Naphthazoloquinoxaline, 1,2,3,4-tetrahydro-, 1123¹.
- C₁₈H₁₁N₃O** 5 γ-Isobenzophenoxazine, 9 dimethylamino-5-imino-, *di-HCl*, 743².
- C₁₈H₁₁N₃O₂** Benzidine, N-(o-nitrophenyl)-, 913⁸.
- Glyoxylohydroxamic acid, phenyl-, 1-naphthylhydrazone, 743¹.
- C₁₈H₁₁N₃O₂** 1-Naphthaldehyde, 5-methoxy-, p-nitrophenylhydrazonone, 909⁸.
- 2,9 - Pyridindole, 1,2,3,4 tetrahydro-2-o-nitrobenzoyl-, 3622².
- C₁₈H₁₁N₃O₇** Naphthalene, dimethyl-, picrate, 900⁸, 1646².
- C₁₈H₁₁N₃O₇** Pyridine, 2(and 4)-(p-amino-benzyl)-, monopicrate, 941².
- C₁₈H₁₁N₃O₈** 3 Pyrrolecarboxylic acid, 2-(2-pyridyl)-, Et ester, picrate, 406⁷.
- 3-Quinolinecarboxylic acid, 2 amino-, Et ester, picrate, 900⁸.
- C₁₈H₁₁O₂P** Phenyl phosphate, 55¹.
- C₁₈H₁₁P** Phosphine, triphenyl-, 875¹.
- C₁₈H₁₁Sb** Stibine, triphenyl-, 3896¹.
- C₁₈H₁₁** Truxane, 1635².
- C₁₈H₁₁Br₂O₂** 1,6-Hexanedione, 2,5-dibromo-, 1,6-diphenyl-, 1645².
- C₁₈H₁₁ClNO₂S** Quinoline, 2-chloro-8-methoxy-3-(p-phenetysulfonyl)-, 1122².
- C₁₈H₁₁Ge** Germane, triphenyl-, 904⁸.
- C₁₈H₁₁GeO** Germane, hydroxytriphenyl-, 904⁸.
- C₁₈H₁₁J₂O₂** Tyrosine, diiodo(diiodotyrosyl)-, 1489⁷.
- C₁₈H₁₁N₂** 1,2-Benzacridine, 7-(aminomethyl)-5,6-dihydro-, and *di-HCl*, 1122².
- C₁₈H₁₁N₂O** α-Naphthalazone, 6,7,8,9-tetrahydro-2-phenylimino-, 1123².
- C₁₈H₁₁N₂O₂** (See also *Analgen*.)
- Quinoline, 3-acetamido-2-p-anisyl-, 2474¹.
- C₁₈H₁₁N₂O₂S** Indole, 1,1'(and 3,3')-sulfonylbis[2-methyl-, 1459¹].
- C₁₈H₁₁N₂O₃** α-Pentenitrile, 3-methoxy-γ-nitro-α,δ-diphenyl-, 223¹.
- 2 - Pyraanbenzoquinolone, 5,6,7,8-tetrahydro - 4,7 - dimethyl - 8 - nitroso -, 411².
- C₁₈H₁₁N₂O₄** Glycine, N-(α-benzamidocinnamyl)-, 1813⁴.
- Isoquinoline, 1,2 - dihydro - 2 - methyl-1-(6 nitropiperonyl)-, 1990⁸.
- C₁₈H₁₁N₂O₅S₂** m Benzenedisulfonanilide, 4-hydroxy-, 3605².
- C₁₈H₁₁N₂O₆** Pyrogallol, 4 phenylazo-, triacetate, 3930⁶.
- C₁₈H₁₁N₂O₇** Pyrogallol, 4-phenylazoxy-, triacetate, 3935⁶.
- C₁₈H₁₁N₂O₈S₂** m Benzenedisulfonanilide, 2,1,6-trihydroxy-, 2676⁶.
- C₁₈H₁₁N₂O₈S** Ethanol, 2,2'-thiobis-, di p-nitrobenzoate, 2876⁶.
- C₁₈H₁₁N₂O₁₀S** Ethanol, 2,2'-sulfonylbis-, di p-nitrobenzoate, 2876⁶.
- C₁₈H₁₁N₂S** Indole, 3,3'-thiobis[2-methyl-, 1459¹].
- C₁₈H₁₁N₂** Carbazole, 3-(2,4 diaminoanilino)-, 3199².
- Glyoxal, 1(and 2)-naphthylphenyl-, dihydrazone, 1811⁴.
- C₁₈H₁₁N₂O₄** 4-Pyridazinecarboxylic acid, 2,5-dihydro - 3 - hydroxy - 5 - keto-2-phenyl-(?), Me ester, phenylhydrazonone, 1973³.
- C₁₈H₁₁N₂O₄** Antipyrine, 4-(m-nitrobenzamido), 1451¹.
- Pyrazine, 2,5-dihydro - 3,6 - dimethyl 2,5-bis(o-nitrophenyl)-, 75¹.
- C₁₈H₁₁N₂O₆** Benzidine, addn. compd. with 2,4-dinitrophenol, 232².
- C₁₈H₁₁N₂S₄** Δ²-Thiodiazoline, 2,2'-dithiobis[5-p-tolylimino-, 3200¹].
- C₁₈H₁₁N₂** 1,2,3-Benzotriazole, 5-(2,4-diaminoanilino) 1-phenyl-, 3199².
- C₁₈H₁₁N₂O₂** 5-Indazolol, 2-methyl-4 (2-methyl-5-indazolyloxy), acetate, 2693².
- C₁₈H₁₁N₂O₂S₂** 1,2,4-Triazol-5(4)-one, 3,3'-di[thiobis[4-p tolyl]-, 2900⁸.
- C₁₈H₁₁O₂** Ether, 1(and 2)-naphthylmethyl o tolyl, 580⁶.
- C₁₈H₁₁O₂** 1,4-Benzopyran, 2-methyl-4-phenacyl-, 2259¹.
- Cyclobutane, 1,2-dibenzoyl-, 1645².
- Truxanediol, 1636².
- C₁₈H₁₁O₃** Δ²-2-Butenone, 4-(p-hydroxyphenyl)-3-methyl-, benzoate, 1803³.
- 3-Pentadienone, 1,5 - bis(m - hydroxyphenyl)-2-methyl-, 1803³.
- C₁₈H₁₁O₄** 1,3 Butanedione, 1-(2,5-cresyl), benzoate, 2472¹.
- Δ²-2-Butenone, 4 - (o - carboxyoxypheyl)-1-phenyl-, Me ester, 80⁸.
- , 4-(3-hydroxy-p-anisyl)-, benzoate, 1449⁸.
- Chalcone, 4' - acetyl - 4 - hydroxy - 3 - methoxy-, 2272².
- Phumaric acid, ditolyl ester, 2893³.
- β-Hydroxyacetic acid, β,γ-diphenyl-, 1032⁸.
- 3-Pentadienone, 1-(4 - hydroxy-m-anisyl)-5-salicyl-, 3600⁴.
- Truxillic acid, 1635².
- C₁₈H₁₁O₅** Coumarin, 3-p-anisyl-5,7-dimethoxy-, 3193⁴.
- Flavone, 3,3',4'-trimethoxy-, 3194⁴.
- Isoflavone, 5-hydroxy - 7,4' - dimethoxymethyl-, 2463⁴.

- 8 - Pentadienone, 1,5 - bis(3,4 - dihydroxyphenyl)-2-methyl-, 1808⁴.
- C₁₈H₁₈O₈ Flavone, 7-hydroxy-3,3',4'-trimethoxy-, 93¹.
- Umbelliferone, 4 - (3,4,5 - trimethoxyphenyl)-, 1981².
- C₁₈H₁₈O₈ Chrysin, 3,3',4'-trimethoxy-, 93¹.
- Coumarin, 5,7 (and 7,8)-dihydroxy-4 (3,4,5-trimethoxyphenyl)-, 1981².
- C₁₈H₁₈O₈ 1,2,5,8-Naphthalenetetrol, tetraacetate, 3053¹.
- C₁₈H₁₇BrO₈ Meconin, 2-(5-bromo-4-methyl-o-anisyl)-, 3356⁹.
- C₁₈H₁₇ClN₂O₈ Naphthionic acid, *N*-acetyl-, *p*-chloroaniline salt, 3362¹.
- C₁₈H₁₇ClO₈ 7 - Hydroxy - 3,2',4' - trimethoxyflavylum chloride, 3620⁹.
- C₁₈H₁₇NO β-Butenonitrile, α-(α-hydroxyphenethyl)-γ-phenyl(?), 228⁷.
- C₁₈H₁₇NO₂ Isoquinoline, 1-benzyl-6,7-dimethoxy-, 1462⁴.
- Δ¹ - 2,3 - Pentenedione, 5-phenyl-, 2-(*O*-benzyloxime), 1106².
- 2 - Pyranobenzoquinolone 5,6,7,8-tetrahydro-4,7-dimethyl-, and chloroplatinate, 411².
- 3(2)-Pyrrolone, 2 - benzyloxy - 2 - methyl-5-phenyl-, 1106⁴.
- C₁₈H₁₇NO₂ Cinchophen, 1-acetyl-1,2,3,4-tetrahydro-, 915¹.
- Crotonophenone, β - amino - 2 - hydroxy-5-methyl-, benzoate, 2472¹.
- 2 - Furanpropanol, 1-naphthalenecarbamate, 3053⁷.
- C₁₈H₁₇NO₂S Quinaldine, 8-methoxy-3-*p*-tolylsulfonfyl-, and salts, 411².
- C₁₈H₁₇NO₂ Diacetanilide, *p*-(*p*-hydroxyphenyl)-, acetate, 403².
- Hippuric acid, *o*-benzoyl-, Et ester, 568⁴.
- C₁₈H₁₇NO₂S Quinaldine, 3-(*o*-anisylsulfonfyl)-8-methoxy-, and salts, 411².
- Quinoline, 2-ethoxy-8-methoxy-3-(phenylsulfonfyl)-, 1122¹.
- C₁₈H₁₇NO₂S Carboxtyril, 8-methoxy-3-(*p*-phenetylsulfonfyl)-, 1122⁴.
- C₁₈H₁₇N₂ Guanidine, α-benzyl-γ-1-naphthyl-, and -HCl, 1463⁹.
- Pyrimidine, 1,4(or 1,6)-dihydro-1,6(or 1,4)-dimethyl - 2 - phenyl-4(or 6) - phenylimino-, 97⁸.
- C₁₈H₁₇N₂O Naphthazoledione, tetrahydro-, phenylhydrazine, 1122², 1123¹.
- C₁₈H₁₇NO₂S 2,4-Thiazolodione, 3,5-diphenyl-, isopropylidenehydrazine, 245⁷.
- C₁₈H₁₇N₂O₂ (See also Nile blue.)
- Hydrazine, α - 2 - naphthyl - β - (α - nitromethylbenzyl)-, 2253⁹.
- C₁₈H₁₇N₂O₂ 1,2,4-Triazole, 1-(acetamidophenyl)-3,5-dimethyl-, picrate, 3200⁷.
- C₁₈H₁₇Br₂O₂ Phenetole, (dibromovinylidene)-bis-, 234².
- C₁₈H₁₇ClNO₂ Acetanilide, 5-chloro-2-(3,4-dimethoxystyryl)-, 580⁹.
- C₁₈H₁₇ClN₂ Pyrimidine, 4-anilino-6-methyl-2-phenyl-, methochloride, 97⁸.
- C₁₈H₁₇Cl₂O₂Zr Compd. from ZrCl₄ and peony oil, 1069⁹.
- C₁₈H₁₇CuO₄, 1417¹.
- C₁₈H₁₇HgN₂O₄ *p*, *p'*-Biacetanilide, 3-(acetoxymercuro-), 2255⁹.
- C₁₈H₁₇NO₂S 3-(*o*-Anisylsulfonfyl) - 1 - methyl-quinaldinium iodide, 411².
- C₁₈H₁₇N₂ Pyrimidine, 4-anilino-6-methyl-2-phenyl-, methiodide, 97⁸.
- C₁₈H₁₇N₂ Carbazole, 9-cyclohexylideneamino-, 3199⁹.
- C₁₈H₁₇N₂O Δ⁴ - 2,3 - Pentenedione, 5-phenyl-, methylphenylhydrazine, 1106².
- 3(2)-Pyrrolone, 2 - methyl - 2 - (N'-methyl-anilino)-5-phenyl-, 1106².
- C₁₈H₁₇N₂O₂ Benzidine, *N*, *N'*-dimethylsuccinyl-, 2891⁹.
- Compd., m. 172°, from 4-ethyl-3,5-dimethyl-2-pyrrolealdehyde, 2701⁹.
- Δ¹ - 3 - Pentenone, 1 - (3,4 - methylenedioxyphenyl)-, phenylhydrazine, 576⁹.
- 2-Pyrrolidone, 1-(anisalamino)-5-phenyl-, 2897².
- 3(2)-Pyrrolone, 4 - hydroxy - 2 - methyl-2-(*N* - methylanilino) - 5 - phenyl-, 1106².
- C₁₈H₁₇N₂O₂ 1-Imidazoleacetic acid, 4-benzyl-tetrahydro-5-keto-2-phenyl-, 1813⁴.
- 2,5 - Piperazinedione, 3-benzyl-6-*p*-hydroxybenzyl-, 614², 378².
- 3 - Pyrrolidone, 2 - methyl - 2 - (N-methyl-anilino)-5-phenyl-, 4,5-peroxide, 1106².
- C₁₈H₁₇N₂O₂S 1-Phenol-4-sulfonanilide, PhNH₂ salt, 3805¹.
- C₁₈H₁₇N₂O₂ Acetoacetamide, naphthylenebis-, P 2805².
- Glycine, *N* - (N'-benzoyl-β-phenylalanyl)-, 1813⁴.
- Glyoxylic acid, (6-hydroxy-2,4-xylyl)-, acetylphenylhydrazine, 1110⁹.
- 2,5-Piperazinedione, 3,6 - bis(*p* - hydroxybenzyl)-, 2260⁹.
- , 1,4-di-*p*-anisyl-, 2256⁹.
- C₁₈H₁₇N₂O₂S Naphthionic acid, *N*-acetyl-, PhNH₂ salt, 3361⁹.
- Quinoline, 2-amino - 8 - methoxy-3-(*p*-phenetylsulfonfyl)-, and salts, 1122².
- C₁₈H₁₇N₂O₂ Acetanilide, 4-(3,4-dimethoxystyryl)-3-nitro-, 580⁷.
- C₁₈H₁₇N₂S 1,4,3-Isotriazodiazine, 4,5-diphenyl-2-propylmercapto-, 391⁹.
- , 2 - (ethylmercapto)-4-phenyl-5-*p*-tolyl-, 391⁹.
- C₁₈H₁₇N₂ *o*-Phenylenediamine, *N*, *N''*-*p*-phenylenebis-, 3199⁹.
- C₁₈H₁₇N₂O₂ 3-Acenaphthenamine, 1,2,3,8a-tetrahydro-, picrate, 84².
- C₁₈H₁₇N₂O₂ 1(2) - Naphthalenone, 7-dimethyl-amino-3,4-dihydro-, picrate, 1123¹.
- C₁₈H₁₇N₂O₂ 1(2)-Naphthalenone, 3,4-dihydro-7-(β - hydroxyethylamino)-, picrate, 1123².
- C₁₈H₁₇N₂O₂ Azoxybenzene, *p*-nitrosohydroxylamine, phenylhydrazine salt, 3048⁹.
- C₁₈H₁₇N₂O₂ 1,2,4-Triazole, 3,5-diethyl-1-phenyl-, picrate, 3201¹.
- C₁₈H₁₇N₂O₁₁ *d*-Glucose, dinitrophenylosazone, 2879⁹.
- C₁₈H₁₇N₂O₁₀, 1417¹.
- C₁₈H₁₇O Chalcone, 4'-propyl-, 77¹.
- C₁₈H₁₇O Chalcone, 6'-methoxy-2',3'-dimethyl-, 1255⁹.
- 1-Indanone, 3-methoxy - 2,2 - dimethyl-3-phenyl-, 3614⁹.
- Tolan, diethoxy-, 234¹.
- C₁₈H₁₇O₂ Δ²-2-Butenone, 4-(4-benzyloxy-m-anisyl)-, 3612⁹.
- Guaiscol, 4-Δ²-butenyl-, benzoate, 1808².
- 1,3 - Propanedione, 1-(*p*-isopropoxyphenyl)-3-phenyl-, 81⁴.
- 9-Xanthencarboxylic acid, butyl-, 3904⁹.
- C₁₈H₁₇O Anthracene, tetramethoxy-, 2894⁹.
- Isozingerone, benzoate, 1449⁹.
- Sinomenol, di-Me deriv., 1656¹.

- C₁₁H₁₆O₃ 1,3-Propanedione, 1-anisyl-3-(3,4-dimethoxyphenyl)-, 81⁸.
 —, 1-phenyl-3-(3,4,5-trimethoxyphenyl)-, 81⁸.
 C₁₁H₁₆O₃ Shikonin, monoacetate, 2904⁹.
 Veratril, 1974⁹.
 C₁₁H₁₆O₇ Veratric anhydride, 92⁹.
 C₁₁H₁₆BrN₄O₃ (6-Bromohomopiperonyl)-trimethylammonium picrate, 1270⁸.
 C₁₁H₁₆BrO₂ Anisole, 2,2'-(bromoethylidene)-bis[5-methyl-, 234².
 Phenetole, (bromovinylidene)bis-, 234².
 C₁₁H₁₆BrO₂ Phenetole, (β-tribromoethylidene)bis-, 234¹.
 C₁₁H₁₆ClO₂ Anisole, 2,2'-(β-trichloroethylidene)bis[4-methyl-, 234¹.
 C₁₁H₁₆NO Cinnamanilide, β-isopropyl-, 220⁴.
 —, β-propyl-, 220².
 as - Homotetrahydroisoquinoline, benzoyl-8-methyl-, 1461².
 Hydrosorbanilide, β-phenyl-, 229².
 β-Pentanilide, γ-methyl-β-phenyl-, 229⁸.
 C₁₁H₁₆NO₂ (See also *Apoecodine*.)
 Cinchophen, 1,2,3,4-tetrahydro-, Et ester, 915¹.
 Crotonic acid, β-(3-α-naphthylamino)-, Et ester, 910⁸.
 Nipeccotic acid, 4,6-diphenyl-, and Ag salt, 906⁹.
 Quinaldine, 1-benzoyl-1,2,3,4-tetrahydro-8-methoxy-, 411², 412².
 2,4-Xylenol, 6-allyl-, carbanilate, 71⁸.
 —, 6-propenyl-, carbanilate, 71⁸.
 C₁₁H₁₆NO₂ Butyric acid, γ-benzoyl-α-methyl amino-β-phenyl-, and -HCl, 906⁸.
 Mandelamide, N-propyl-, benzoate, 1095⁸.
 α-Toluic acid, 2-methoxy 4,6-dimethyl-α-phenylimino-, Me ester, 1116⁸.
 C₁₁H₁₆NO₂ Codeinone, hydroxy-, 3234².
 Homopiperonylamide, N-(β-methoxyphenethyl)-, 1462⁴.
 Phthalamic acid, N-(β-methoxyphenethyl)-, Me ester, 1462⁸.
 α-Tolamide, N-(β-methoxyhomopiperonyl)-, 1462².
 C₁₁H₁₆NO₂S Naphtholsulfonic acid, xylylidene salt, 1646⁸, 3361⁹.
 C₁₁H₁₆NO₂ Codeinone, dihydrohydroxy-, 3234².
 Veratric acid, 6-(β-benzamidoethyl)-, 1817¹.
 C₁₁H₁₆NO₂S 2-Naphtholsulfonic acid, p-phenetidine salt, 1646⁸.
 C₁₁H₁₆N₂O₂ 1,4-Pyrene, tetrahydro-2-phenyl-, 4-phenylsemicarbazone, 2901⁹.
 C₁₁H₁₆N₂O₂ Benzoic acid, 5-acetamido-2-(p-acetamidooanilino)-, 232².
 —, 3,5-diacetamido-2-anilino-, Me ester, 2250⁴.
 Isobutyrophenone, α-hydroxy-, acetate, p-nitrophenylhydrazone, 3611⁷.
 C₁₁H₁₆N₂NaO₁₀S Pseudourea, tetramethylthio-, methopicate, Na picrate, 2878⁸.
 C₁₁H₁₆AsN₂O₂ m-Arsanilic acid, N-(m-nitrobenzoyl)-4-(1-piperidyl)-, and salts, 2894².
 C₁₁H₁₆BrN₂O₂ Acetamide, α-bromo-N-(β-hydroxy-γ,γ'-diphenylisobutyl)-, 508⁸.
 C₁₁H₁₆BrN₂ 2-Formyl-1,3,3-trimethylindolinium bromide, phenylhydrazone, 407².
 C₁₁H₁₆BrN₂O₂ Rhamnose, p-bromophenyl-osazone, 1969².
 C₁₁H₁₆BrO₂ Anisole, 2,2'-(β,β-dibromoethylidene)bis[4-methyl-, 234¹.
 Phenetole, (β,β-dibromoethylidene)bis-, 234¹.
 C₁₁H₁₆ClNO₂ 7-Benzoyloxy-3,4-dihydro-6-methoxy-2-methylisoquinolinium chloride, 968².
 C₁₁H₁₆ClN₂ 2-Formyl-1,3,3-trimethylindolinium chloride, phenylhydrazone, 407².
 C₁₁H₁₆ClO₂Zr Addn. compd. of ZrCl₄ and mandelic acid Me ester, 1069⁴.
 C₁₁H₁₆HgN₂O₂ Compd. from p-acetamidobenzoic acid and Hg(OAc)₂, 70⁸.
 C₁₁H₁₆IN₂ 2-Formyl-1,3,3-trimethylindolinium iodide, phenylhydrazone, 407².
 C₁₁H₁₆N₂OS₂ Carbonic acid, dithiol-, Et p-methylphenacyl ester, phenylhydrazone, 391⁸.
 —, dithiol-, phenacyl Pr ester, phenylhydrazone, 391⁸.
 C₁₁H₁₆N₂O₂ Aniline, N[6-(β-methyl-β-methylaminoethyl)piperonylidene-], 1990².
 p-Anisidine, N,N'-dimethylacetylenbis-, 1073¹.
 Benzamide, N,N'-2,3-butylenebis-, 2120¹.
 p,p'-Biacetanilide, N,N'-dimethyl-, 2891⁸.
 2,2'-Bi-m-acetotoluide, 2889².
 p,p'-Bipropionanilide, 2884².
 p-Phenetidine, N,N'-acetylenebis-, 1973¹.
 C₁₁H₁₆N₂O₂S Propionanilide, β,β'-thiobis-, 1262¹.
 C₁₁H₁₆N₂O₂S₂ o-Acetotoluide, 4,4'-dithiobis-, 234⁸.
 C₁₁H₁₆N₂O₂ 2,3-Butanedione, 1-phenyl-, 2-(5-dimethoxyphenyl)hydrazone, 1269⁸.
 C₁₁H₁₆N₂O₂ o-Oxaloanilide, 5,5'-dimethyl-, 1971¹.
 Phenylhydrazone, softens 110°, decomps. 140°, from compd. from di-Et xanthophanate, 1266⁷.
 C₁₁H₁₆N₂O₂S Ethanol, 2,2'-thiobis-, di-p-aminobenzoate, 2876⁸.
 C₁₁H₁₆N₂O₂S₂ o-Acetotoluide, 4,4'-dithiobis-, S dioxide, 234⁸.
 C₁₁H₁₆N₂O₂S Ethanol, 2,2'-sulfonylbis-, di-p-aminobenzoate, 2876⁸.
 C₁₁H₁₆N₂O₂S₂ Carbanilic acid, p,p'-dithiobis-, di-Et ester, S-dioxide, 234⁸.
 C₁₁H₁₆N₂S₂ 7,8-Benzheptamethylenimine phenylthiourea, 2696⁸.
 C₁₁H₁₆N₂O₂ 2-Butene, 2,3-bis(p-anisylazo)-, 1973¹.
 Cyclohexylamine, N-[p-(p-nitrophenyl)-azophenyl]-, 1102⁴.
 Ethylene, s-bis(p-phenetylazo)-, 1972⁸.
 Ilydrazine, β-carbonyl-α-methyl-α-oxotolyl-, dimer, 2890⁸.
 C₁₁H₁₆N₂O₂ Acetophenone, 4-(N-carbethoxyanilino)semicarbazone, 69².
 C₁₁H₁₆N₂O₂ Benzenecarbamic acid, o-acetyl-, di-Me ester, phenylhydrazone, 1124⁴.
 C₁₁H₁₆N₂O₂ Cyclohexylamine, N-phenyl-, picrate, 1800¹.
 C₁₁H₁₆N₂S₂ 1,3,4-Triazole-2-mercaptan, 1-xylyl-5-xylylamino-, 2900⁸.
 C₁₁H₁₆N₂S₂ 1,4-Piperazinedicarboxamide, N,N'-diphenyldithio-, 1799¹.
 C₁₁H₁₆N₂O₂ 4,4'-Bisemicarbazide, 1,1'-di-phenacylidene-, 1249².
 C₁₁H₁₆N₂S₂ 1,4-s-Tetrazinedicarboxamide, 2-aminodithio-5-toluino-N¹-tolyl-(?), 2901⁸.
 —, dithio-2,5-ditoluino-(?), 2901⁸.
 1,4-s-Tetrazinedicarboxytoluide, 2,5-diaminodithio-(?), 2901⁸.

- C₁₈H₂₀O** Butyrophenone, α -ethyl- α -phenyl-, 1626⁹.
Isocaprophenone, α -phenyl-, 567⁶.
C₁₈H₂₀O₂ *p*-Dioxane, 2,5-dimethyl-2,5-diphenyl-, 2465⁴.
1 - Isobenzofuranol, 2,2-diethyl-1,2-dihydro-1-phenyl-, 1648².
C₁₈H₂₀O₃ Guaiacol, 4-butyl-, benzoate, 1803³.
C₁₈H₂₀O₄ Thebaone, dihydrohydroxy-, Me ether, 2698⁹.
Veratrole, 4,4'-vinylidenebis-, 1975⁵.
C₁₈H₂₀O₅ *o*-Veratric acid, 6-(2-methoxy-6-methylbenzyl)-, 3357².
C₁₈H₂₀O₆ Veratrolin, 1974⁹.
C₁₈H₂₀O₇ Veratrilic acid, 1974⁹, 1975⁴.
C₁₈H₂₀O₈ Δ^3 - Cyclohexene - Δ^1 . β - propionic acid, α , β - diacetyl-5-carboxy-2,6-diketo-, di-Et ester, 1265⁸.
C₁₈H₂₁BrO₂ Phenetole, (β -bromoethylidene)bis-, 234².
C₁₈H₂₁Br₂NO Pseudocumenol, 3,6-dibromo- α^4 -[dimethylaminotolyl]-, 903¹.
—, 3,6 - dibromo - α^4 - (*p*-ethylmethylaminophenyl)-, 903¹.
C₁₈H₂₁Br₂NO₂ Pseudocumenol, 3,6-dibromo- α^4 - (4 - dimethylamino-*m*-anisyl)-, 903¹.
C₁₈H₂₁CoN₂O₈ + H₂O, 867³.
C₁₈H₂₁LiN₃S₂, 3571⁴.
C₁₈H₂₁N Benzalimine, α -(α , α -diethylbenzyl)-, -II Br, 1626⁹.
peri - Indolocarbazole, 1,2,3,4,4b,5,6,7, -7a,12b-decahydro-, 3199⁴.
Piperidine, 5-benzyl-2-phenyl-, 2130⁶.
C₁₈H₂₁NO Acetamide, *N*, *N*-diethyl- α , α -diphenyl-, 2888⁴.
Benzanilide, *p'*-(β -methylbutyl)-, 1801⁹.
Butyrophenone, α -ethyl- α -phenyl-, oxime, 1626⁹.
C₁₈H₂₁NO₂ Benzilamide, *N*, *N*-diethyl-, 2888⁴.
 β , δ -Hexadienic acid, α -(cyclohexylimino)-*p*-phenyl-, 2882⁹.
2,4-Xylenol, 6-propyl-, carbanilate, 71⁸.
C₁₈H₂₁NO₂S Benzenesulfonamide, *N*-cyclohexyl-*N*-phenyl-, 1102³.
C₁₈H₂₁NO₃ (See also *Codeine*.)
Formamide, *N* - (4 - benzyloxy-3-methoxyphenethyl)-*N* methyl-, 96⁸.
Guaiacol, (γ -aminobutyl)-, benzoate, -II Br, 1449^{8,9}.
C₁₈H₂₁NO₃S Glycine, *N*, δ -phenylbutyl-*N*-(phenylsulfonyl)-, 2696².
—, *N* - (phenylsulfonyl) - *N* - (γ -*p*-tolyl-propyl)-, 1461¹.
C₁₈H₂₁NO₇ Malonic acid, (β -hydroxy- γ -phthalimidopropyl)-, di Et ester, 624².
C₁₈H₂₁N₃ Cyclohexylamine, *N*-(*p*-phenylazophenyl)-, 1102³.
C₁₈H₂₁N₃O₁ Benzoic acid, 5-acetamido 2-(*p*-dimethylaminoanilino)-, Me ester, 2259⁶.
Isobutyrophenone, α - hydroxy - 2,5 - dimethyl-, *p*-nitrophenylhydrazones, 3611⁸.
C₁₈H₂₁N₃O₁ Diacetylisonitroso deriv., m. 180-1⁹, of base from BzCH₂CN and piperidine, 2902⁴.
C₁₈H₂₁N₃O₇ Ethylenediamine, *N*-(1,2,3,4-tetrahydro-2-naphthyl)-, picrate, 566⁸.
C₁₈H₂₁N₃O₈ Trimethyl[γ - (nitrophenyl)-propyl]ammonium picrate, 2254⁴.
C₁₈H₂₁AsN₃O₁ *m*-Arsanilic acid, *N*-(*m*-amino-benzoyl)-4-(1-piperidyl)-, and salts, 2694⁹.
C₁₈H₂₁Br₁N₃S₂ β -Naphthothiazole, 2-heptyl-amino-, tetradecebromide, 584⁴.
C₁₈H₂₁ClIN₃O₁ 2,8-Diamino-3,7-dihydroxy-10-methylacridinium chloride, P 593⁸.
C₁₈H₂₁IN 1,2,3,4,7,8,9,10 - Octahydro-12-methyl-2,3-benzacridinium iodide, 1123³.
C₁₈H₂₁N₂ Aniline, *p*, *p'*-vinylidenebis[*N*, *N*-dimethyl-, perchlorate, 1110⁸.
Piperazine, 2,3 - dimethyl - 1,4 - diphenyl-, 1810².
C₁₈H₂₁N₂O Acetamide, *N*-phenethyl- α -phenethylamino-, and -II Cl, 1657⁷.
Salicylaldehyde, 5-isoamyl-, phenylhydrazones, 69⁹.
C₁₈H₂₁N₂O₂ See *Holocrine*.
Anisaldehyde, 5-benzyloxy-2-(β - methylaminomethyl)-, oxime, 96⁸.
Arabinal, benzylphenylhydrazones, 3190⁶.
Codeinone, dihydro-, isoxime, 2697⁹.
C₁₈H₂₁N₂O₆ Tartaric acid, 2,2' bi-*m*-toluidine salt, 2892².
C₁₈H₂₁N₂S β - Naphthothiazole, 2-heptyl amino-, 584⁴.
C₁₈H₂₁N₂O 2-Butanone, 4-phenyl-, 4-(*N*-methylavilino)semicarbazone, 69⁹.
Levulinic acid, α -methyl-, phenylhydrazide, phenylhydrazones, 244¹.
C₁₈H₂₁N₂O₇ Biacetyl, *p*-anisylsazone, 1973³.
Glyoxal, *p*-phenetylosazone, 1973².
C₁₈H₂₁N₂O₈ Glucoside, 2302⁸.
C₁₈H₂₁N₂O₈ 2-Naphthylamine, *N*, *N*-diisobutyl-1,6,8-trinitro-, 404⁷.
C₁₈H₂₁N₂O₇ Ethyldimethylphenethylammonium picrate, 2660⁴.
Propylamine, γ -*p*-cumenyl-, picrate, 1461².
Trimethyl[γ - phenylpropyl]ammonium picrate, 2254⁴.
C₁₈H₂₁N₂O₈ Propylamine, γ -*p*-anisyl-*N*, *N*-dimethyl-, picrate, 2660³.
C₁₈H₂₁N₂O₉ Phenethylamine, 3,4-dimethoxy-*N*, *N*-dimethyl-, picrate, 2660⁴.
C₁₈H₂₁N₂O₈ Addn. compd. of caffeine and oxalic acid, 2359².
C₁₈H₂₁N₂O₁₁ (β - Aminoethyl)ethyldimethylammonium picrate, picrate, 2660⁴.
C₁₈H₂₁O₂ 3,4-Hexanediol, 1,6 diphenyl-, 3188⁶.
C₁₈H₂₁O₄ 2-Naphthol, decahydro-, acid phthalate, 1112⁵.
Phthalic acid, monobornyl and monoisobornyl esters, 577⁷, 2682².
Thebaone, tetrahydrohydroxy Me ether, 2698⁹.
C₁₈H₂₁O₅ Benzohydrol, 3,4,3',4'-tetramethoxy- α -methyl-, 1975⁵.
1,1 - Cyclopropanedicarboxylic acid, 2-(α , α - dimethylpropionyl)-3-phenyl-, di-Me ester, 894².
C₁₈H₂₁O₈ Compd., m. 60-70⁹, from di-Et xanthophanate, 1260⁷.
C₁₈H₂₁BrO₁ Malonic acid, α -(bromopivalmethyl)benzyl-, di Me ester, 894².
C₁₈H₂₁N *peri*-Indolocarbazole, 1,2,3,4,4a,4b-, 5,6,7,7a,12a,12b dodecahydro-, and -II Cl, 3199⁴.
C₁₈H₂₁NO Benzohydrol, α (α -aminoisomyl)-, 567⁹.
C₁₈H₂₁NO₂ See *Lobeline*.
C₁₈H₂₁NO₃ Cinchophen, 1-acetyl-1,2,3,4-, 1',2',3',4',5',6'-decahydro-, 915¹.
C₁₈H₂₁NO₄ Hippuric acid, *N*-(*o*-carboxycyclohexyl)-, di-Me ester, 245⁴.
C₁₈H₂₁N₂O₁ Codeinone, dihydro-, isoxime, 2698¹.
C₁₈H₂₁N₂O₂ Propiophenone, α -anilino-3-hydroxy - 5 - methyl - α - semicarbazido-, semicarbazone, 911⁴.
C₁₈H₂₁CoN₂O₈ + H₂O, 867³.

- C₁₁H₂₃ClN** Dimethyldiphenethylammonium chloride, 26604.
- C₁₁H₂₃ClNO** Chloro deriv. of tetrahydronormethylmorphimethine, *and salts*, 11251.
- C₁₁H₂₃N₂** 2,3-Butanediamine, *N, N'*-di-*p*-tolyl-, 18009.
- C₁₁H₂₃N₂O₂** 4-Isopyrrolicarboxylic acid, 2-[4-(4-ethyl-3,5-dimethyl-2-pyrryl)-methylene]-3,5-dimethyl-, Et ester, 27015.
- Yohimben, 4132.
- C₁₁H₂₃N₂O** 3-Pyrrolicarboxylic acid, 5,5'-ethylidenebis[2-methyl-, di-Et ester, 3816.
- C₁₁H₂₃N₂O₂** Benzenesulfonamide, *N, N'*-1,4-butylenebis[*N*-methyl-, 19646.
- C₁₁H₂₃N₂O** Glutamic acid, *N*-(*N*-acetyl- β -phenylalanyl)-, di-Me ester, 6123.
- C₁₁H₂₃N₂S** Urea, α -heptyl- β -1-naphthylthio-, 5849.
- C₁₁H₂₃N₂O₄** Gluconic acid, 2-keto-, phenylhydrazone, PhNHNH₂ salt, 24607.
- Sarcosine, addn. compd. with 4-phenylazoresorcinol, 685.
- C₁₁H₂₃O₄** Malonic acid, β -1-indanylethyl-, di-Et ester, 26841.
- Phthalic acid, monomethyl ester, 28894.
- Spiro[cyclohexane - 1,1' - cyclopropane-2',1' - cyclohexane] - 2,6,2'',6'',tetrone, 4,4,3',4'',4''-pentamethyl-, 32035.
- C₁₁H₂₃O₄** Malonic acid, α [(α)- α -dimethylpropionyl)methyl]benzyl-, di-Me ester, 8941.
- , ethyl[α - (α - formylisopropyl)benzyl]-, di-Me ester, 30441.
- C₁₁H₂₃NO₂** Cinchophen, 1,2,3,4,1',2',3',4',-8',6'-decahydro-, Et ester, 9151.
- Phthalimide, Δ -deacyl-, 26589.
- C₁₁H₂₃NO** Morphimethine, tetrahydro, normethyl-, 11252.
- C₁₁H₂₃NO₂** Pyrrolidinedicarboxylic acid, 1- β -methylbenzyl-, di-Et ester, *and* -HCl, 4128, 4131.
- C₁₁H₂₃N₂** Amine, m 148°, from cryptopyrrole, 27018.
- C₁₁H₂₃** Benzene, *p*-dicyclohexyl-, 24702.
- C₁₁H₂₃IN₂** Diphenylamine, *p, p'*-bis(dimethylamino)-, ethiodide, 26707.
- C₁₁H₂₃N₂O₂** Butyric acid, β (*N* isonamyl *p*-nitrobenzamido)-, ethyl ester, 28768.
- C₁₁H₂₃N₂O₂** 2,5-Piperazinedione, 1,4-dimethyl-, *o*-phenylenediamine addn. compd., 17972.
- C₁₁H₂₃O** Cyclohexanone, 2 (2-cyclohexylidene-cyclohexylidene)-, 2315.
- Phenol, 2,6-dicyclohexyl-, 24642.
- C₁₁H₂₃O₂** Δ 1-3-Hendecenone, 1-(4-hydroxy-*m*-anisyl)-, 36233.
- C₁₁H₂₃O₄** 1,3-Cyclohexanedione, 2,2'-ethylidenebis[4,4-dimethyl-, 32035.
- C₁₁H₂₃O₆** 3,6 - Spirooctane - 1 - valeric acid, δ , 3,7 - triketo - β , β , 2,5,5 - pentamethyl-, 32034.
- C₁₁H₂₃NO₂** Caproic acid, α cyclohexylamino-*e*-phenyl-, 28831.
- Δ 1-1-Hendecenol, carbanilate, 8941.
- C₁₁H₂₃NO₂** 2-Butanol, 1-(β -dimethylaminoethoxy)-2-methyl-, cinnamate, -HCl, 38897.
- C₁₁H₂₃N₂O** Benzamide, *N, e*-(2-methyl-1-piperidyl)amyl-, 967.
- C₁₁H₂₃N₂O₂** Caproamide, *N, N'*-*p*-phenylenebis-, 28844.
- C₁₁H₂₃N₂O₂S** Cystine, tetracarboxy-, 31852.
- C₁₁H₂₃N₂O₄** 1,1,4,4 - Butanetetra-carboxylic acid, 2,3 dimethyl-, tetra-Et ester, di-Na deriv., 36039.
- C₁₁H₂₃O₂** Acid from whale oil, 13662, 17199.
- Cyclohexanone, α, α' -dicyclohexyl-, hydro-pyrene deriv., 24647.
- C₁₁H₂₃O₂** 3-Decanone, 1-(3,4-dimethoxyphenyl)-, 36237.
- 3-Hendecanone, 1 - (4 - hydroxy-*m*-anisyl)-, 36239.
- C₁₁H₂₃O₄** 1,1,2,2 - Cyclobutanetetra-carboxylic acid, 3,3 dimethyl-, tetra-Et ester, 36037.
- C₁₁H₂₃Br₂NO₂** Caryophyllene, allyloxynitroso-, tetrabromide, 2372.
- C₁₁H₂₃NO** Caryophyllene, allyloxynitroso-, 2372.
- C₁₁H₂₃NO₂** 3-Decanone, 1-(3,4 dimethoxyphenyl)-, oxime, 36237.
- C₁₁H₂₃NO₂S** Undecylic acid, methylphenylsulfonamido-, 2585.
- C₁₁H₂₃N₂O₂** Caprylophenone, 4-hydroxy-3-propyl-, semicarbazone, 19747.
- C₁₁H₂₃N₂O₂** 3-Nonanone, 1-(3,4-dimethoxyphenyl)-, semicarbazone, 36237.
- C₁₁H₂₃N₂O₄** Isocaproamide, α -butylamino-*N*-ethyl-, picrate, 16579.
- C₁₁H₂₃Br₂O₂** Stearic acid, hexabromo-, 22502; *salts*, 8942, 3, 38892.
- C₁₁H₂₃N₂** Isoquinoline, 1,2,3,4-tetrahydro-2-(β -1 piperidylethyl), dimethiodide, 4101.
- C₁₁H₂₃NO₂** See *Butyn*.
- C₁₁H₂₃N₂O₂S** 2,5 Piperazinedione, 3,3' dithiodimethylenebis[6-isobutyl-, 19661.
- C₁₁H₂₃N₂O** Isoamylamine, *N, N*-diethyl- α -isobutyl-, picrate, 33462.
- Tetrapropylammonium picrate, 13972.
- C₁₁H₂₃O₂** Acid from whale oil, 13662, 17199.
- Eleostearic acid, 16294.
- Linolenic acid, 22502, 22943, 28102.
- 2-Naphthol, 3 - cyclohexyldecahydro-, acetate, 11146.
- C₁₁H₂₃O₂** Chaulmoogric acid, λ -keto-, 17995.
- C₁₁H₂₃O₄** 1,1,4,4 - Butanetetra-carboxylic acid, 2,3-dimethyl-, tetra-Et ester, 36035.
- C₁₁H₂₃O** Galactose, diacetoneglucosido-, 16351.
- C₁₁H₂₃NO** Chaulmoogramide, λ -keto-, 17999.
- Cinchophen, hexadecahydro-, Et ester, *and* -HCl, 9152.
- C₁₁H₂₃NO₂** Caryophyllene, α propyleneglycoxy-nitroso-, 2372.
- C₁₁H₂₃N₂O** Cyclohexanone, methyl-, 4-bornyl-semicarbazone, 36132.
- C₁₁H₂₃** Hydrocarbon from copal, 18897.
- C₁₁H₂₃Br₂NO₂** Piperazine, 1,4-bis(α -bromo-isopropyl)-2,5-dimethyl-, 3839.
- C₁₁H₂₃Br₂O₂** Stearic acid, tetrabromo-, 22502; *salts*, 38892.
- C₁₁H₂₃O₂** Chaulmoogric acid, 9015, 17094.
- Eleostearic acid, 28099, 37532.
- Linoleic acid, 4259, 22502, 23272.
- Stearic acid, 19082, 33487.
- C₁₁H₂₃O₄** Malonic acid, Δ^9 -hendecenyl-, di-Et ester, 8954.
- C₁₁H₂₃O** Isovalerin, 14789.
- C₁₁H₂₃O₁₀** Biosan, hexamethyl-, 1748.
- C₁₁H₂₃O₁₀** (See also *Melzitose*; *Raffinose*.)
- Cellobiose, 34562.
- d*-Glucose, 6- β -cellobiosido- β -, 11018.
- , 6- β -lactosido- α - β -, 11019.
- C₁₁H₂₃N** Tricyclohexylamine, *and* -HBr, 17999.
- C₁₁H₂₃NO** Butyric acid, γ -cyclohexyl- α -cyclohexylamino-, ethyl ester, 28827.
- C₁₁H₂₃Br₂O₂** Bromine addn. product of alcohol from bark, 5999.

- Stearic acid, *θ*, *δ*-dibromo-, 732⁸.
 C₁₈H₃₄Cl₂O₂ Stearic acid, *α*, *α*-dichloro-, 2875⁹.
 C₁₈H₃₄O₂ (See also *Elaidic acid*; *Oleic acid*.)
 Acid from parsley seed oil, 3475¹.
 Alcohol from bark, 599⁹.
o-Heptadecenoic acid, *α*-methyl-, 2874¹.
 Petroselinic acid, 2661⁹.
 C₁₈H₃₄O₂ (See also *Ricinoleic acid*.)
 Stearic acid, keto-, 952⁹.
 C₁₈H₃₄O₂ 1,12-Dodecanedicarboxylic acid,
 di-Et ester, 391¹, 3182⁹.
 1,16 - Hexadecanedicarboxylic acid, 390⁹.
 Juniperic acid, acetate, 2119⁴.
 1,13 - Tridecanedicarboxylic acid, 1(2 and
 4)-methyl-, di-Me ester, 3349⁹, 3350^{1,2}.
 C₁₈H₃₄O₁₆ *d*-Glucosyl-*α*-arabinoside, hexamethyl-
 methyl-, 393¹.
 C₁₈H₃₄BrO₂ Stearic acid, bromo-, 1908¹.
 C₁₈H₃₄ClNO Palmitamide, *α*, *α*-dichloro-*N*-
 ethyl-, 2875⁹.
 C₁₈H₃₄IO₂ Rosilic acid, iodo deriv., and salts,
 893⁹.
 C₁₈H₃₄N₂O₂ Adipic acid, *α*, *δ*-bis(diethylamino)-,
 di-Et ester, 60².
 C₁₈H₃₄N₂O₂ Cyclohexanol, 4-(*β*-aminoethyl)-,
 oxalate, 1805⁴.
 C₁₈H₃₄N₂O₂ Piperazine, 1,4-dileucyl-2,5-di-
 methyl-, and di-*HBr*, 383⁹.
 C₁₈H₃₄O₂ (See also *Stearic acid*.)
 Margaric acid, *α*-methyl-, 2250¹.
 Myristic acid, Bu ester, P 593³.
 C₁₈H₃₄O₂ Stearic acid, *α*-mercapto-, 3045⁹.
 C₁₈H₃₄O₂ Rosilic acid, and *Ba salt*, 893⁹.
 Stearic acid, hydroxy-, 895⁷, 952⁹.
 C₁₈H₃₄O₂ Stearic acid, dihydroxy-, 599⁹, 950¹.
 C₁₈H₃₄O₂ Saticic acid, 426¹, 599⁹.
 C₁₈H₃₄NO Palmitamide, *N*-ethyl-, 2875⁹.
 C₁₈H₃₄N₂O₂ 1,6-Hexanediol, 2,5-di-1-piperi-
 dyl-, dimethiodide, and isomer, 598⁹.
 C₁₈H₃₄N₂O Isocaproamide, *α*-diisooamylamino-
N-ethyl-, 1657⁹.
 C₁₈H₃₄Cl₂N₂O₂Pt *γ* - Carboxy - *γ* - (hydroxy-
 propyl)trimethylammonium chloroplati-
 nate (?), di-Et ester, 1632¹.
 C₁₈H₃₄N₂ Piperazine, 1,4-bis(*η*-aminoheptyl)-,
 and di-*HCl*, 566⁹.
 C₁₈H₃₄Cu₂N₄S₂ Tetratriaminopropylsulfuric
 hexathiocyanate, 388⁹.
 C₁₈H₃₄N₂O Benzanthrone, dicyano-, P 2136⁹.
 C₁₈H₃₄Cl₂N₂ Dibenzopyridoquinoxaline, 11,12
 (or 12,13)-dichloro-, 1986⁹.
 C₁₈H₃₄Cl₂NO Benzamide, *N*, *N*-bis(2,4,6-
 trichlorophenyl)-, 3190⁴.
 Benzimidic acid, *N*-(2,4,6-trichlorophenyl)-,
 2,4,6-trichlorophenyl ester, 3190⁴.
 C₁₈H₃₄NaO₂ Pyrogallolbenzein, tri-Na deriv.,
 1983¹.
 C₁₈H₃₄Br₂Cl₂O₂ Phenolsulfonephthalein, di-
 bromodichloro-, 1111⁴.
 C₁₈H₃₄Br₂O₂ Pyrogallolbenzein, dibromo-,
 1982⁹.
 C₁₈H₃₄Br₂O₂ Bromophenol blue, 1773¹.
 C₁₈H₃₄ClN₂ Dibenzopyridoquinoxaline, 11(or
 13)-chloro-, 1986⁹.
 C₁₈H₃₄N₂O₂ Pyrogallolbenzein, dinitro-, 1983¹.
 C₁₈H₃₄N₂O₁₅ Methane, tris(2,4-dinitrophenyl),
 1111⁴.
 C₁₈H₃₄O₂ Δ^{1,2'} - Bi[indan]-3,1',3'-trione, 2-
 methylene-, 2666⁹, 3362⁹.
 10,12(11)-Diindenopyrandione, 3362⁹.
 C₁₈H₃₄O₂ 1,3-Indandione, 2,2'-methylenebis-,
 3202⁹.
 Spiro[indan - 2,1' - cyclopropane-2',2''-
 indan]-1,8,1'',3''-tetrone, 3203⁹.
- C₁₈H₁₁BrN₂O₂ 3-Pyranoquinolone, 2-bromo-8-
 methyl-, picrate, 382⁹.
 C₁₈H₁₁BrO₂ 4,3-*β*-Naphthopyrone, 2-bromo-1-
 phenyl-, 3616⁴.
 C₁₈H₁₁Cl₂N₂O 5(4) - Isoindazolone, 4,4',6,7,7-
 pentachloro - 6,7 - dihydro-1,3-diphenyl-,
 2693³.
 C₁₈H₁₁N₂ Dibenzopyridoquinoxaline, 1986⁹.
 C₁₈H₁₁N₂S Acridine deriv., m. 216⁹, 2690⁴.
 C₁₈H₁₁Br₂N₂O Phenol, 2,6-dibromo-4,4'-azo-
 bis-, monobenzoate, 1971⁹.
 C₁₈H₁₁Br₂O₂ Phenolsulfonephthalein, di-
 bromo-, 1111⁴.
 C₁₈H₁₁Cl₂O₂ Phenolsulfonephthalein, dichloro-,
 1111⁴.
 C₁₈H₁₁Cl₂NO Benzamide, *N*-phenyl-*N*-(2,4,6-
 trichlorophenyl)-, 3190⁴.
 —, 2,4,6-trichloro-*N*, *N*-diphenyl-, 3190⁴.
 Benzimidic acid, *N*-phenyl-, 2,4,6-trichloro-
 phenyl ester, 3190⁴.
 —, 2,4,6-trichlorophenyl-, Ph ester, 3190⁴.
 C₁₈H₁₁N₂O₂ 4-Acridol, picrate, 1461⁷.
 C₁₈H₁₁N₂O₂ 3-Pyranoquinolone, 8-methyl-,
 picrate, 411¹.
 C₁₈H₁₁O₂ 4,3-*β*-Naphthopyrone, 1-phenyl-,
 3616⁴.
 C₁₈H₁₁O₂ Pyrogallolbenzein, and salts, 1982⁹.
 C₁₈H₁₁BrClNO Benzamide, 2'-bromo-6'-
 chloro-4'-phenyl-, 2680⁴.
 C₁₈H₁₁Br₂N₂O₂ 4-Nitro-1,2-diphenylbenziso-
 thiazolium bromide, 2603².
 C₁₈H₁₁BrO₂ Phenolsulfonephthalein, bromo-,
 1773¹.
 C₁₈H₁₁BrNO Benzanilide, 2',4'-dibromo-6'-
 phenyl-, 1260¹.
 C₁₈H₁₁ClN₂O₂ 2,1,3 - Benzotriazol-4(7)-one,
 6-chloro-5-hydroxy-7-phenylimino - 2 - *p*-
 tolyl-, 2689⁷.
 C₁₈H₁₁ClO₂ Phenolsulfonephthalein, chloro-,
 1773¹.
 C₁₈H₁₁Cl₂NO Benzamide, *N* - (2,4 - dichloro-
 phenyl)-*N*-phenyl-, 3190⁴.
 Benzanilide, 2',4'-dichloro-6'-phenyl-, 1259⁴.
 Benzimidic acid, *N*-(2,4-dichlorophenyl)-,
 Ph ester, 3190⁴.
 —, *N*-phenyl-, 2,4-dichlorophenyl ester,
 3190⁴.
 C₁₈H₁₁IN₂ 9-Fluorenone, 2-iodo-, phenyl-
 hydrazone, 1643⁹, 3360⁹.
 C₁₈H₁₁NO₂ 7,8 - Benzoquinoline-2,4-diol, 3-
 phenyl-, 1987⁴.
 C₁₈H₁₁NO₂ 1,2-Oxyquindolinediol, diacetate,
 1984⁴.
 C₁₈H₁₁N₂ Pyrido[2,3-*β*]pyrazine, 2,3-diphenyl-,
 1986⁹.
 C₁₈H₁₁N₂O₂ Isoindazole, 5-nitro-1,3-diphenyl-,
 2693³.
 C₁₈H₁₁N₂O₂ 2,4(1,3) - Pyrimido[4,5-*β*]quinoline-
 dione, benzoyl-9-methoxy-, 377⁹.
 C₁₈H₁₁N₂O₂ Phenol, 2-nitro-4,4'-azobis-,
 monobenzoate, 1971⁹.
 C₁₈H₁₁N₂O₂S *α*, *α*' - Bi - *o* - toluenesulfonic
 acid, *α*, *α*' - dihydroxy - 5,5' - dinitro-,
 dianhydride, pyridine deriv., 909⁷.
 C₁₈H₁₁N₂O₂S Benzoisothiazole, 5-(*p*-nitrophenyl-
 azimino)-1-phenyl-, 2692⁴.
 C₁₈H₁₁BrClOP Phosphine, [(*p*-bromophenyl)-
 diphenylmethoxy]dichloro-, 66⁹.
 C₁₈H₁₁BrNO Benzanilide, 4'-bromo-2'-phenyl-,
 1259⁴.
 C₁₈H₁₁BrN₂O₂ Xenylamine, 4'-bromo-*N*-
 methyl-2,2'-dinitro-*N*-phenyl-, 376⁹.
 C₁₈H₁₁BrO₂ *p*-Toluenesulfonic acid, 2,6
 dibromo-4-phenylphenyl ester, 2680⁴.

- C₁₉H₁₈ClNO** Benzamide, *o*(and *p*)-chloro-*N*, *N*-diphenyl-, 3190⁴.
Benzanilide, 4'-chloro-2'-phenyl-, 1259⁴.
Benzimidic acid, chlorophenyl-, Ph ester, 3190^{3,4}.
Benzimidic acid, *N*-phenyl-, *m*-chlorophenyl ester, 3190³.
C₁₉H₁₈ClN Isoindazole, 5-amino-4-chloro-1,3-diphenyl-, 2693³.
C₁₉H₁₈ClN₂O Benzophenone, 2-chloro-5-nitro-, phenylhydrazine, 2693³.
C₁₉H₁₈ClN₂O₄ Xenylamine, 4'-chloro-*N*-methyl-2,2'-dinitro-*N*-phenyl-, 379⁷.
C₁₉H₁₈Cl₂NO₂P Phosphine, dichloro[(*p*-nitrophenyl)diphenylmethoxy]-, 67².
C₁₉H₁₈Cl₂OP Phosphine, dichloro[(*p*-chlorophenyl)diphenylmethoxy]-, 66⁹.
C₁₉H₁₈N₂O₂ 1,2-Benzacridine-7-carbamic acid, Me ester, 1122⁸.
C₁₉H₁₈N₂O₂ Benzamide, *N*-(*o*-nitrophenyl)-*N*-phenyl-, 3190⁴.
Benzimidic acid, nitrophenyl-, Ph ester, 3190^{3,4}.
Phenol, *p*, *p'*-azobis-, monobenzoate, 1971⁸.
2-Quinoxalinol, 3-(2-hydroxy-7-methoxy-1-naphthyl)-, 1646⁶.
C₁₉H₁₈N₂O₂S Benzenesulfenamide, 2-benzoyl-4-nitro-, 2693³.
C₁₉H₁₈N₂O₄ 2-Isoindolinebutyronitrile, *β*-hydroxy-1,3-diketo-, benzoate, 62⁸.
Methane, (2,4-dinitrophenyl)diphenyl-, 1110⁹.
Phenol, *p*, *p'*-azoxybis-, monobenzoate, 1972^{1,2}.
C₁₉H₁₈N₂O₂S Phenol, *p*-phenylsulfonylazo-, benzoate, 68⁸.
C₁₉H₁₈N₂O₂ Nicotine, C₂O₂ addn. compd., 735⁸.
C₁₉H₁₈N₂O₂S Phenol, 2-nitro-4-(*p*-nitrophenyl)-, *p*-toluenesulfonate, 1109⁸.
C₁₉H₁₈N₄ Benzotriazole, 5-benzalamino-phenyl-, 2689^{8,9}.
C₁₉H₁₈N₄O₂ 2,1,3-Benzotriazole-4,5-dione, 2-phenyl-7-*p*-toluino-, 3904⁴.
C₁₉H₁₈N₄O₂S 1,3-Diphenyl-5-isoidazole-diazonium sulfate, 2693³.
C₁₉H₁₈N₄S Benziisothiazole, 2-phenyl-4-phenyl-azoimino-, 2693³.
C₁₉H₁₈O Fuchson, 2266⁸.
C₁₉H₁₈O₂ Benzaurin, 2266⁸.
Naphthopyrone, 1,2-dihydro-1-phenyl-, 3616⁸.
—, 3-*o*-tolyl-, 3197³.
C₁₉H₁₈O₂ Aurin, 2266⁸.
Ketone, 2-hydroxy-1-naphthyl phenyl, acetate, 3616⁸.
1-Naphthoic acid, 8-*o*-toluyl-, 3197³.
1,2- α -Naphthopyran-5,6-dione, 3,4-dihydro-2-phenyl-, 241⁷.
1,4-Naphthoquinone, 2-hydroxy-3-(γ -phenylallyl)-, 241⁷.
C₁₉H₁₈O₄ 7-meso-Benzanthrone, hydroxy-dimethoxy, 2894^{8,9}.
2-Naphthoic acid, 1,4-dihydro-1,4-diketo-3-phenyl-, Et ester, 1647⁸.
C₁₉H₁₈O₄ $\Delta^1(9)\alpha$ -Furanacetic acid, 4,5-dihydro-3,5-diketo- α ,4-diphenyl-, Me ester, 1110⁴.
—, 3-hydroxy-5-keto- α ,4-diphenyl-, Me ester, 1110⁴.
3,4,5,6-Xanthenetetrone, 9-phenyl-(?), 1983¹.
C₁₉H₁₈O₄S See *Phenolsulfonesphalein*.
C₁₉H₁₈O₄ Anthraquinone, 2,4-dihydroxy-1-methyl-, diacetate, 3053⁴.
Coumarin, 5,7(and 7,8)-dihydroxy-3-phenyl-, diacetate, 3193⁴.
Shikizarin, diacetate, 2905¹.
C₁₉H₁₈Br Methane, bromotriphenyl-, 3887¹.
C₁₉H₁₈Cl Methane, chlorotriphenyl-, 2266⁷.
C₁₉H₁₈Cs Cesium triphenylmethyl, 890⁹.
C₁₉H₁₈Li Lithium triphenylmethyl, 892¹.
C₁₉H₁₈N Aniline, *N*-diphenylmethyle-, SnCl₄ addn. compd., 3902¹.
 β -Naphthazole, 1-methyl-2-phenyl-, 1263².
Xenylamine, *N*-benzal-, 237⁸.
C₁₉H₁₈NO Phenol, *p*-(*p*-benzalamino-phenyl)-, 238³, 403³.
C₁₉H₁₈NO₂ Acetamide, *N*-(7-hydroxy-2-naphthyl)-, benzoate, 909⁷.
1,2-Benzacridine-7-carboxylic acid, 5,6-dihydro-2-methoxy-, 1123⁸.
Benzamide, *N*-(7-hydroxy-2-naphthyl)-, acetate, 909⁷.
Quinaldine, 8-methoxy- α -piperonylidene-, and *chloroplatinate*, 412².
C₁₉H₁₈NO₂ Coptisine, 3622⁹.
C₁₉H₁₈NO₂S Phenol, *p*-(*p*-nitrophenyl)-, *p*-toluenesulfonate, 1109⁸.
C₁₉H₁₈NO₂ 2(1)-Benzofuranone, 1-(*o*-aminobenzal)-5,6-dihydroxy-, diacetate, -HCl, 1984⁴.
C₁₉H₁₈NS Benzimidic acid, *N*-phenylthio-, Ph ester, 77⁸.
C₁₉H₁₈N Isoindazole, 5-amino-1,3-diphenyl-, 2693³.
C₁₉H₁₈Rb Rubidium triphenylmethyl, 890⁹.
C₁₉H₁₈ See *Methane*, *triphenyl*-.
C₁₉H₁₈AsIO 6-Methyl-6-phenylphenoxarsonium iodide, 1654¹.
C₁₉H₁₈AsN₂O₂ Benzanilide, 5-(3-amino-4-hydroxyphenylarseno)-2-hydroxy-, P 745².
C₁₉H₁₈BrNO₂S *p*-Toluenesulfonanilide, 4'-(*p*-bromophenyl)-, 2680⁴.
C₁₉H₁₈BrNO₂S Quinaldine, 3-(*p*-bromophenylsulfonyl)- α -ethylidene-8-methoxy-, 412².
C₁₉H₁₈BrO₂P Methanephosphonic acid, (*p*-bromophenyl)diphenyl-, and salt, 66⁹.
C₁₉H₁₈ClNO₂S Quinaldine, 3-(*p*-chlorophenylsulfonyl)- α -ethylidene-8-methoxy-, 412².
C₁₉H₁₈ClO₂P Methanephosphonic acid, (*p*-chlorophenyl)diphenyl-, and *di-K salt*, 66⁹.
C₁₉H₁₈N₂ Benzophenone, phenylhydrazine, SnCl₄ addn. compd., 3902¹.
C₁₉H₁₈N₂O Benzanilide, 2'-amino-4'-phenyl-, 237⁸.
Salicylaldehyde, 5-phenyl-, phenylhydrazine, 1109⁸.
C₁₉H₁₈N₂OS Carbanilic acid, *p*-(*p*-aminophenyl)thiono-, Ph ester, 80⁴.
C₁₉H₁₈N₂O₂S Carbazole, 3-*p*-tolylsulfonamido-, 3199².
C₁₉H₁₈N₂O₂ Cinchoninic acid, 6-(*p*-acetamidophenyl)-2-methyl-, 2473⁷.
3-Quinolincarboxylic acid, 2-benzamido-, Et ester, 906⁸.
C₁₉H₁₈N₂O₂S *p*-Toluenesulfonanilide, 2'-nitro-4'-phenyl-, 237⁸.
C₁₉H₁₈N₂O Benzimidazole, 7-(2-hydroxy-1-naphthylazo)-2,5-dimethyl-, 1813³.
C₁₉H₁₈N₂O₄ 1,4-Pyrene, 2,6-dimethyl-3,5-bis(phenylazo)-, 3192⁷.
C₁₉H₁₈N₂O₄ Aniline, *p*, *p'*-(2,4-dinitrobenzal)-bis-, 1110⁴.

- C₁₉H₁₈N₄O₈ Pyridine, 2-*p*-phenetyl-, picrate, 585².
- C₁₉H₁₈N₄O₉ 3-Pyranoquinolone, 7,8,9,10-tetrahydro-8-methyl-, picrate, 411¹.
- C₁₉H₁₈N₄O₁₀ Diphenylguanidinium picrate, 1397².
- C₁₉H₁₈O Carbinol, triphenyl, 1482⁷, 2266⁷, 3483⁸, 3887¹.
Ether, benzohydril phenyl, 580^{4,4}, 3613⁴.
Phenol, *o*-benzohydril (?), 580⁴.
- C₁₉H₁₈O₈ 1,4-Thiopyrone, dibenzaltetrahydro-, 1262³.
- C₁₉H₁₈O₉ Carbinol, (*p*-hydroxyphenyl)diphenyl-, 2266⁸.
- C₁₉H₁₈O₁₀ Cyclopentenone, methyl(3,4 methylenedioxyphenyl)phenyl-, 576⁴.
Maleic anhydride, α -benzyl β -phenethyl-, 2467⁷.
Succinic anhydride, α -benzal- β -phenethyl-, 2467⁷.
- C₁₉H₁₈O₁₁ Phenol, *p*-phenyl-, *p*-toluenesulfonate, 1109⁸.
- C₁₉H₁₈O₁₂ Hydrocinnamic acid, mixed anhydride with β -benzoylacrylic acid, 2259².
2-Indanacetic acid, 1,3-diketo-2-phenyl, Et ester, 1647⁶.
2-Naphthoic acid, 1,4-dihydroxy-3-phenyl, Et ester, 1647⁶.
- C₁₉H₁₈O₁₇ Acetophenone, α ,2,4 trihydroxy, α -benzoate, diacetate, 93⁷.
Arabonic acid, lactone, dibenzoate, 1446⁸.
- C₁₉H₁₇AsIN 1,6-Dihydro-1-methyl-1-phenyl-1-phenarsazonium iodide, 1654¹.
- C₁₉H₁₇BrClP Benzylphosphorodiphenylphosphonium chloride, 66⁸.
- C₁₉H₁₇NO₂ 3-Quinolinebutyric acid, 2-phenyl, and salts, 2695⁷.
- C₁₉H₁₇NO₃ Cinchophen, 4'-methoxy-6,8-dimethyl-, 3622².
Quinoline, 8-methoxy-2-(3,4-methylenedioxyphenethyl)-, and chloroplatinate, 412².
- C₁₉H₁₇NO₄ Isoquinoline, 6,7-dimethoxy-1-piperonyl-, 1462⁴.
- C₁₉H₁₇NO₅ 5(4)-Oxazolone, 2-phenyl-4 (2,4,6-trimethoxybenzyl)-, 1120⁸.
- C₁₉H₁₇N₃ Aniline, *p*, *p'* (phenylmethyl-ene)bis-, 403².
Guanidine, α , β , γ -triphenyl-, 67⁶.
- C₁₉H₁₇N₃O Evodiamine, 2134⁷.
- C₁₉H₁₇N₃O₂ Aniline, *p*, *p'*-(*o*-nitrobenzal)bis-, 1110⁸.
Evodiamine, hydroxy-, 2135¹.
- C₁₉H₁₇N₃O₄ Pyrimidine, 4-anilino-6-methyl-2-phenyl-, hydrogen oxalate, 97⁸.
- C₁₉H₁₇N₃O₇ Naphthalene, ethylmethyl-, picrate, 907².
Picrate, m. 139-40⁸, from tetracyclosqualene, 1112².
- C₁₉H₁₇N₃O₇S 1-(Dinitrotolyl)pyridinium *p*-toluenesulfonate, 1640¹.
- C₁₉H₁₇N₃O₈ Naphthalene, ethylmethyl-, styphnate, 907².
- C₁₉H₁₇N₃O₁₁ Gallaldehyde, tris(methyl carbonate), *p*-nitrophenylhydrazone, 2886⁴.
- C₁₉H₁₇N₃S Carbanilide, *p*-(*p*-aminophenyl)thio-, 80⁶.
- C₁₉H₁₇N₅ Benzimidazole, 7-(2-amino-1-naphthylazo)-2,5-dimethyl-, 1813⁸.
- C₁₉H₁₇N₅O₉ Trimethyl(nitro-2-naphthyl)ammonium picrate, 3616^{2,2}.
- C₁₉H₁₇O₂P Methanephosphonic acid, (*m*-hydroxyphenyl)diphenyl-, and di-Na salt, 67¹.
- C₁₉H₁₇BrNO Carbazole, benzoylbromohexahydro-, 2898⁴.
- C₁₉H₁₇Br₂N₂O Pseudocumenol, 3,6-dibromo- α -(3 and 5)-methyl-5 (and 3)-phenyl-1-pyrazolyl-, 903².
- C₁₉H₁₇N₂O 2-Pyrrolidone, 1-cinnamalamino-5-phenyl-, 2897².
- C₁₉H₁₇N₂O₂ γ -Pentenanilide, α -(α -aminothienylidene)- β -keto- δ -phenyl-, 734².
- C₁₉H₁₇N₂O₂ Carbazole, benzoylhexahydro-, nitro-, 2898⁴.
2,7-Fluorenediamine, *N*, *N*, *N'*-triacyetyl-, 238⁸.
- C₁₉H₁₇N₂O₄ Alanine, *N* (α -benzamidocinnamyl)-, 1813⁹.
- C₁₉H₁₇N₂O₅₂ *m*-Benzenedisulfonanilide, 2-hydroxy-5-methyl-, 3897⁴.
- C₁₉H₁₇N₂O₈ 2,4-Thiazolidione, 3-(α -methylbenzalamino)-, 2- α -methylbenzalhydrazone, 245⁹.
- C₁₉H₁₇N₂O₈ 4-Pyridazinecarboxylic acid, 2,5-dihydro-3-hydroxy-5-keto-2-phenyl(?), Et ester, phenylhydrazone, 1473².
- C₁₉H₁₇N₂O₉ Benzidine, addn. compd. with 2,4-dinitrotoluene, 232².
- C₁₉H₁₇N₂O₇ Trimethyl-2-naphthylammonium picrate, 3616².
- C₁₉H₁₇N₂O₈ Hydrohydrastinine, 3 methyl-1-(2,4,6-trinitrobenzyl)-, 1900².
- C₁₉H₁₇N₂O₁₀ Propane, 2,2-bis(2,4,6-trinitro-3,5-xylyl)-, 2657⁹.
- C₁₉H₁₇O₂ Cinnamic acid, 5,6,7,8-tetrahydro-2-naphthyl ester, 1983⁷.
- C₁₉H₁₇O₃ Succinic anhydride, α benzyl- β -phenethyl-, 2887⁴.
- C₁₉H₁₇O₄ Maleic acid, α -benzyl- β -phenethyl-, 2467⁷.
Maleic anhydride, α -benzyl- β -phenethyl-, 2467⁶.
Succinic acid, α benzal- β -phenethyl-, 2467⁶.
- C₁₉H₁₈O₅ 9-Anthrol, 3,4,6-trimethoxy-, acetate, 2895¹.
Carbonic acid, bis(4-vinyl *o*-anisyl) ester, 3050².
Chalcone, 2'-hydroxy-3,4-dimethoxy-, acetate, 3194⁴.
Isoflavone, 5,7,4'-trimethoxy-2-methyl-, 246².
3-Pentadienone, 1,5-bis(4-hydroxy-*m*-anisyl)-, 3609⁴.
- C₁₉H₁₈O₄ Chalcone, 3,4,5-trimethoxy-3',4'-methylenedioxy-, 3356⁸.
Coumarin, 7-methoxy-4-(3,4,5-trimethoxyphenyl)-, 1941².
Flavone, 5,7,3',4'-tetramethoxy-, 1120⁸.
1,2,4-Naphthalenetriol, 3-allyl-, triacetate, 241⁸.
- C₁₉H₁₈O₇ Flavone, 7-hydroxy-3,5,3',4'-tetramethoxy-, 1267⁴.
- C₁₉H₁₇BrCl₂O Anthracene, 9-bromo-1,5-dichloro-10-ethoxy-9-(ethoxymethyl)-9,10-dihydro-, 1260⁸.
- C₁₉H₁₇BrO₂ Hydrocinnamaldehyde, β -(α -bromophenacyl)- α , α -dimethyl-, 3044⁸.
- C₁₉H₁₇NO₂ Chalcone, 4'-acetyl-4-dimethylamino-, 2272⁹.
- C₁₉H₁₈NO₃ Triobine, 2699^{4,4}.
- C₁₉H₁₈NO₄ See *Domesticine*.
- C₁₉H₁₈NO₅ Quinaldine, 8-methoxy-3-(phenethylsulfonyl)-, and salts, 411^{4,4,4,4}.
- C₁₉H₁₈NO₆ Coptisine, tetrahydro-, 3622².
Propionic acid, β -benzoyl- β -hydroxy- α -phenyl, Me ester, oxime, acetate, 5837⁸.

- C₁₁H₁₉NO₃** Homopiperonylamide, *N*-(β -methoxyhomopiperonyl)-, 1462².
Phthalamic acid, *N*-(β -methoxyhomopiperonyl)-, Me ester, 1462².
C₁₁H₁₉NO₃S Cysteic acid, diphenacyl ester, 8185³.
C₁₁H₁₉NO₄U, 2231¹.
C₁₁H₁₉N₃O₃S Naphthionic acid, *N*-acetyl-, 5-nitro-*o*-toluidine salt, 3362¹.
C₁₁H₁₉Cl₃NO₃ Morphine, trichloroacetate, 3905⁹.
C₁₁H₁₉IN₃ Pyrimidine, 4-methyl-6-(*N*-methyl-anilino)-2-phenyl-, methiodide, 97⁴.
C₁₁H₁₉N₃O₃S 4 - Quinazolinocarboxylic acid, 4 - ethoxy - 1,2,3,4 - tetrahydro-3-phenyl-2-thioketo-, Et ester, 587⁹.
C₁₁H₁₉N₃O₄ Hydrohydrastinine, 3-methyl 1-*o*-nitrobenzyl-, 1990².
 3 - Pyrrolidone, 5-*p*-anisyl-2-methyl-2-(*N*-methylanilino)-, 4,5-peroxide, 1106⁴.
C₁₁H₁₉N₃O₄S Benzoic acid, thioureidobis-, di-Et ester, 378⁸, 1637⁹.
 Naphthionic acid, *N*-acetyl-, toluidine salt, 3361¹.
C₁₁H₁₉N₃O₄S Naphthionic acid, *N*-acetyl-, *p*-anisidine salt, 3362¹.
C₁₁H₁₉N₄ Malononitrile, ⁶bis(*p*-dimethylamino-phenyl)-, 403⁶.
C₁₁H₁₉N₄O 1,2,4-Triazole, 1-(benzamidophenyl)-3,5-diethyl-, and salts, 3200⁹.
C₁₁H₁₉N₄O₃ Propane, 2,2-bis(dinitro-3,5-xylyl), 2657⁹.
C₁₁H₁₉N₄O₁₂ α -Glucoseptose, dinitrophenyl osazone, 2879⁷.
C₁₁H₁₉O₂ Chalcone, 4'-hydroxy-5'-isopropyl 2'-methyl-, 1974⁹.
 Hydrocinnamaldehyde, β (α hydroxyphenacyl)- α , α -dimethyl-, 3044⁷.
 Phenol, *p*-cyclohexyl-, benzoate, 3046⁷.
C₁₁H₁₉O₃ Benzophenone, 4-hydroxy-5-isopropyl 2-methyl-, acetate, 1456¹.
 Chalcone, 2',6'-diethoxy-(?), 1255¹.
 9-Xanthencarboxylic acid, butyl-, Me ester, 3904⁸.
C₁₁H₁₉O₄ 4(4a)-Phenanthrene, 1,10a dihydro-3,5,6-trimethoxy-1-vinyl, 1656².
C₁₁H₁₉O₅ 1,3,6-Naphthalenetetracarboxylic acid, 4,7-dimethyl-, di-Et ester, 1647².
C₁₁H₁₉ClN₂O Benzoic acid, β -(*p*-chlorophenyl)- β -cyclohexylhydrazide, 2672³.
C₁₁H₁₉N Cyclohexylamine, *N*-diphenyl-methylene-, 3901⁵.
C₁₁H₁₉NO 2-Piperidone, 6,6-dibenzyl-, and -HCl, 1108⁴.
C₁₁H₁₉NO₃ See Thebaine.
C₁₁H₁₉NO₄ Dehydrosinomenine, and -HCl, 1655⁹.
C₁₁H₁₉NO₄S Naphtholsulfonic acid, pseudocumidine salt, 1646⁵, 3361¹.
C₁₁H₁₉NO₅ Malonic acid, (2-carboxy-3-indyl-methylene)-, tri Et ester, 583⁴.
C₁₁H₁₉NO₅U Piperidine disalicylatoumate, 2231¹.
C₁₁H₁₉N₂O₂ Benzaldehyde, nitro-, cyclohexyl-phenylhydrazone, 1102³.
C₁₁H₁₉N₂O₃ Δ^2 -2-Butenone, 4-(4-benzoyloxy-m-anisyl)-, semicarbazone, 3612³.
 2 - Propanone, 1 - (5,6,7,8 - tetrahydro-2-naphthyl-1,3,3 - trimethylindolinium iodide, methylphenylhydrazone, 4077.
C₁₁H₁₉N₂O₄ Carbamic acid, (*p*-tolylazoglyoxy)-, Et ester, *p*-tolylhydrazone, 1654¹.
C₁₁H₁₉IN₃ 2-Formyl-1,3,3-trimethylindolinium iodide, methylphenylhydrazone, 4077.
C₁₁H₂₁N Benzaldehyde, cyclohexylphenyl-hydrazone, 1102³.
 Piperidine, 2,2-dibenzyl-6-amino-, and salts, 1108⁴.
C₁₁H₂₁N₂O (See also Cinchonidine.)
 Benzaldehyde, *p*-hydroxy-, cyclohexyl-phenylhydrazone, 1102³.
 Benzoic acid, β -cyclohexyl- β -phenylhydrazide, 1102⁷.
C₁₁H₂₁N₂O₂ Cinchonine, *N*-oxide, 384⁴.
 Compd., m. 96, 5⁹, from Me₂NH and 2,3-dibromo-1,4-diphenyl-1,4-butane-dione, 82¹.
 Hydrocinnamic acid, β -(α -formylisopropyl)-, phenylhydrazone, 3044².
 β -Phenetidine, *N*, *N'*-methylacetylenebis-, 1973¹.
C₁₁H₂₁N₂O₃ Benzoic acid, *p*-(α -*p*-phenetylimino-ethylamino)-, Et ester, and -HCl, 236⁴.
C₁₁H₂₁N₂O₄ Compd., m. 130-1⁹, from acetyl- β -methylmorphinethine, 1125¹.
 Dehydrosinomenine, oxime, 1655⁹.
 1,4-Pentanediol, dicarbanilate, 1962¹.
 Propane, 2,2-bis(nitro-3,5-xylyl)-, 2657⁹.
 Salicylic acid, 5-(α -*p*-phenetyliminoethyl-amino)-, Et ester, and -HCl, 236⁴.
C₁₁H₂₁N₂O₅ 3-Pyrrolopropionic acid, 2,2'-methylenebis[5-carboxy-4-methyl-, 104².
C₁₁H₂₁N₂O₆ Propene, 1,2-bis(*p*-phenetylazo)-, 1972⁹.
C₁₁H₂₁N₂O₈ Quininesulfonic acid diazo-5-anhydride, dihydro-, 247⁶.
C₁₁H₂₁N₂O₇ as - Homotetrahydroisquinoline, 8-isopropyl-, picrate, 1461².
C₁₁H₂₁N₂O₈ α -Glucoseptose, nitrophenyl-osazone, 2879⁷.
C₁₁H₂₁O₅ Deoxycatechol, tetramethyl-, 1120⁹.
C₁₁H₂₁O₆ Acetophenone, 3,4 dimethoxy- α -(2,4,6-trimethoxyphenyl)-, 1120⁹.
C₁₁H₂₁Br₂N₂O Pseudocumolol, 3,6-dibromo- α -(dimethylaminoxyl)-, 903¹.
C₁₁H₂₁ClN₂O₄ Benzohydrolyl, *p*, *p'*-bis(dimethylamino) - α - vinyl-, perchlorate, 1110⁹.
C₁₁H₂₁N *peri*-Indolocarbazole, 1,2,3,4,4b,5,6,9a,12b-decahydro-9-methyl, 3199⁴.
C₁₁H₂₁NO Benzamide, *N*-(γ -*p*-cumenylpropyl)-, 1461².
 2,4-Benzoxylide, *N*-butyl-, 2670⁶.
C₁₁H₂₁NO₃ as - Homotetrahydroisquinoline, benzenesulfonyl-8-isopropyl-, 1461².
C₁₁H₂₁NO₃ (See also Dionine.)
 Base from des-*N*-methyl-dihydrohydroxy-thebaine, and -HBr, 2698⁶.
 Dauricine, 2700⁷.
C₁₁H₂₁NO₄ (See also Sinomenine.)
 Porphyroxine, 588⁷.
 α -Tolamide, *N* - (β - 3,4 - trimethoxy-phenethyl)-, 1462⁴.
C₁₁H₂₁NO₅ Malonic acid, (2-carboxy-3-indyl-methyl)-, tri-Et ester, 583⁴.
C₁₁H₂₁NO₇ Benzylethylhydroxyphenylammonium acid tartrate, 65⁹.
 Benzylhydroxymethyl - *p* - tolylammonium acid tartrate, 66¹.
C₁₁H₂₁N₂ Cyclohexylamine, *N*-methyl-*N*-(*p*-phenylazophenyl)-, 1102³.
C₁₁H₂₁N₂O Semicarbazide, 1-cyclohexyl-1,4-diphenyl-, 1102³.
C₁₁H₂₁N₂O₂ Dinitrile from dihydrocodeinone, 2698¹.
C₁₁H₂₁N₂O₃S Benzenesulfonic acid, *p*-(*p*-cyclohexylmethylaminophenylazo)-, 1102³.

- C₁₉H₂₃N₃S Semicarbazide, 1-cyclohexyl-1,4-diphenylthio-, 1102².
- C₁₉H₂₃N₃O₇ 1,3-Propanediamine, *N*-(1,2,3,4-tetrahydro-2-naphthyl)-, picrate, 566².
- C₁₉H₂₃N₃O₉ *m* (and *p*)-Nitrobenzyltriethylammonium picrate, 73².
- C₁₉H₂₃ Propane, 2,2-di-3,5-xylyl-, 2657².
- C₁₉H₂₃ClNO₂ + 2H₂O See *Dionine*.
- C₁₉H₂₃N₂ Imidazole, tetrahydro-4,5-dimethyl-1,3-di-*p*-tolyl-, 1809².
- 2-Naphthylamine, *N*-[*p*-(β -aminoethyl)-benzyl]-, and salts, 566².
- C₁₉H₂₃N₂O Benzohydrol, *p*, *p'*-bis(dimethylamino)- α -vinyl-, 1110².
- Curarine, 413².
- Propionamide, *N*-phenethyl- α -phenethylamino-, and -HCl, 1657².
- C₁₉H₂₃N₂O₂ Acetamide, α -amino-*N*-(β -hydroxy- α -methyl- γ , γ' -diphenylisobutyl)-, 568².
- Propionamidine, *N*, *N'*-di-*p*-phenetyl-, 236².
- C₁₉H₂₃N₂O₂ Codeinone, dihydro-, isoöxime, Me ether, and -HI, 2698¹.
- Morphimethine, tetrahydrocyanonormethyl-, 1124², 1125².
- C₁₉H₂₃N₂O₃S Cinchonansulfonic acid, dihydro-, 248¹.
- C₁₉H₂₃N₂O₂ Porphyrroxine, oxime, 589².
- C₁₉H₂₃N₂O₃S Cinchoninesulfonic acid, 5-hydroxydihydro-, 248¹.
- C₁₉H₂₃N₂S Carbanilide, 2,2',4,4',5,5'-hexamethylthio-, 671².
- C₁₉H₂₃N₂ Adipaldehyde, β -methyl-, bisphenylhydrazine, 2889².
- C₁₉H₂₃N₂O₂ Pyruvaldehyde, *p*-phenetylosazone, 1973².
- C₁₉H₂₃N₂O₇ Benzyltriethylammonium picrate, 73².
- C₁₉H₂₃N₂O₅ Pentanol, dimethylamino-5-phenyl-, picrate, 592².
- C₁₉H₂₃N₂O₂ 2-Propanone, 1-amino-1-phenyl-, di-Et acetal, picrate, 75².
- C₁₉H₂₃Br₂NO₂ Hydrocinnamic acid, α , β -dibromo- α -(and *p*)-nitro-, menthyl ester, 907².
- C₁₉H₂₃NO₂ Cinnamic acid, α -(*m* and *p*)-nitro-, menthyl ester, 907².
- Des-*N*-methylidihydrohydroxycodeinone, dihydro-, 2698¹.
- Hydrosinomenine, 1655².
- C₁₉H₂₃NO₁₂ *d*-Glucosheptononitrile, hexaacetyl-, 1634¹.
- C₁₉H₂₃N₂O₂ Codeinone, dihydro-, isoöxime, Me ether, oxime, 2698¹.
- C₁₉H₂₃N₂O₇ 1,5-Pentanediamine, *N*-phenethyl-, picrate, 566².
- C₁₉H₂₃N₂O₂ Propiophenone, 2-hydroxy-5-methyl- α -semicarbazido- α -*o*-toluino-, semicarbazone, 1911².
- C₁₉H₂₃IN *peri*-Indolocarbazole, 1,2,3,4,4a,4b,5,6,7,7a,12a,12b-dodecahydro-, methiodide, 3199².
- C₁₉H₂₃N₂O₂ Benzophenone, *p*, *p'*-bis(dimethylamino)-, di-Me acetal, 403².
- C₁₉H₂₃N₂O₄ Compd. from acetyl- β -methylmorphimethine, 1125¹.
- Hydrosinomenine, oxime, 1655².
- 2-Pyrrolocarboxylic acid, 5,5'-methylenebis[3,4-dimethyl-, di-Et ester, 85².
- C₁₉H₂₃O₂ Cinnamic acid, menthyl ester, 908¹.
- C₁₉H₂₃O₂ Ketone, 5-hydroxy-2,2,3,3,5-pentamethylcyclopentyl methyl-, benzoate, 1970¹.
- C₁₉H₂₃O₄ Malonic acid, β -(1,2,3,4-tetrahydro-1-naphthyl)ethyl-, di-Et ester, 2684².
- C₁₉H₂₃O₁₁ Glucoheptose, β -hexaacetyl-, 2362¹.
- C₁₉H₂₃NO₂ Cinnamic acid, α -(*m* and *p*)-amino-, menthyl esters, and -HCl, 907².
- Cyclohexanol, 2-cyclohexyl-, carbanilate, 375².
- Δ^5 -2-Hexenol, 4-(1-piperidylmethyl)-, benzoate, salts, 1121².
- Morphimethine, deoxytetrahydro- α -methyl-, perchlorate, 247².
- C₁₉H₂₃NO₄ 2,6-Piperidinedicarboxylic acid, 1-*p*-methylbenzyl-, di-Et ester, 413¹.
- C₁₉H₂₃ Methane, dicyclohexylphenyl-(?), 3360¹.
- C₁₉H₂₃INO₄ 2,2-Dicarboxy-1-methyl-1-*p*-methylbenzylpyrrolidinium iodide, di-Et ester, 413¹.
- C₁₉H₂₃N₂ Phenethylamine, *p*-phenethylaminomethyl-, dimethiodide, 566².
- C₁₉H₂₃N₂O Propiophenone, α , β -di-1-piperidyl-, 3905².
- C₁₉H₂₃N₂O₄ Carbanilic acid, *p*-carboxy-, Et ester, 2-(dimethylaminomethyl)cyclohexyl ester, 1970².
- C₁₉H₂₃O₂ *p*-Cresol, 2,6-dicyclohexyl-, 2464¹.
- C₁₉H₂₃O₂ Cinnamic acid, decyl ester, 2659².
- C₁₉H₂₃O₂ Δ^1 -3-Dodecenone, 1-(4-hydroxy-m-anisyl)-, 3623².
- C₁₉H₂₃O₂ Lauric acid, salicylate, 1328².
- C₁₉H₂₃NO₂ 1-Dodecenol, carbanilate, 2873².
- Morphimethine, dihydrodeoxytetrahydro- α -methyl-, and salts, 247².
- C₁₉H₂₃N₂ Benzene, 1-(β -1-piperidylethyl)-2-(1-piperidylmethyl)-, 409².
- C₁₉H₂₃O₂ Etiocholanone, 591¹.
- C₁₉H₂₃O₂ 3-Dodecanone, 1-(4-hydroxy-m-anisyl)-, 3623².
- 3-Hendecanone, 1-(3,4-dimethoxyphenyl)-, 3623².
- C₁₉H₂₃O₂ Etiobilanic acid, 591¹.
- C₁₉H₂₃O₁₄ Fructoside, tetracarboethoxymethyl-, 2880².
- C₁₉H₂₃N₂ 1-Hexanol, 2-(α -aminoethyl)-2-butyl-, benzoate, -HCl, 3347².
- C₁₉H₂₃NO₂ 3-Hendecanone, 1-(3,4-dimethoxyphenyl)-, oxime, 3623².
- C₁₉H₂₃N₂O₂ 3-Decanone, 1-(3,4-dimethoxyphenyl)-, semicarbazone, 3623².
- C₁₉H₂₃N₂O₄ Hexaethylguanidinium picrate, 2878².
- C₁₉H₂₃O₂ Carboxylic acid from copal, 1889².
- C₁₉H₂₃O₁₁ Trihexosan, monomethyl-, 393².
- C₁₉H₂₃Br Methane, bromotricyclohexyl-, 1799¹.
- C₁₉H₂₃N₂O₂ Chaulmoogric acid, λ -keto-, semicarbazone, 1799².
- C₁₉H₂₃ Methane, tricyclohexyl-, 1799², 3360¹.
- C₁₉H₂₃O Carbinol, tricyclohexyl-, 1799².
- C₁₉H₂₃O₂ Pelargonic acid, geranyl ester, 1407².
- C₁₉H₂₃N₂OS Pseudothiohydantoin, 5-hexadecyl-, 3045².
- C₁₉H₂₃O₂ ω -Heptadecenic acid, α -methyl-, methyl ester, 2874².
- Oleic acid, Me ester, 2458².
- C₁₉H₂₃O₂ Stearic acid, keto-, methyl ester, 952².
- C₁₉H₂₃O₂ 1,12-Dodecanedicarboxylic acid, 2-methyl-, di-Et ester, 3340².
- Thapsic acid, methyl-, di-Me ester, 3355².
- C₁₉H₂₃O₁₁ Turanose, heptamethyl-, 393¹.
- C₁₉H₂₃NO₂ 1,9-Nonanediol, 2,8-di-1-piperidyl-, and chloroplatinate, 591².
- C₁₉H₂₃N₂O₂ Pimelic acid, α , α' -bis(diethylamino)-, di-Et ester, 60².
- C₁₉H₂₃O₂ Stearic acid, Me ester, 506².

- , α -methyl-, 22501.
 $C_{10}H_{15}O_2$ Stearic acid, hydroxy-, Me ester, 895^a, 952^a.
 $C_{20}H_{13}Cl_3O$ Rose bengal, 2567, 4517.
 $C_{20}H_{13}Cl_4$ Perylene, hexachloro-, 18111.
 $C_{20}H_{12}Br_4N$ α -Dibenzophenazine, tetrabromo-, 2895^a.
 $C_{20}H_{12}Br_2O$ See *Eosin*.
 $C_{20}H_{12}Cl_2N_2O_4$ Perylene, dichlorodinitro-, 1810^a.
 $C_{20}H_{12}Cl_4$ Perylene, 3,4,9,10-tetrachloro-, 1810^a.
 $C_{20}H_{12}I_4O$ Erythrosin, 1734^a, 2286^a, 3021^a.
 $C_{20}H_{12}N_2O_5$ Perylenequinone, dinitro-, P 3026^a.
 $C_{20}H_{12}N_4O_3S$ Sulfide, bis(1,6,8-trinitro-2-naphthyl), 404^a.
 $C_{20}H_{12}N_4O_3S_2$ Disulfide, bis (1,6,8-trinitro-2-naphthyl), 404^a.
 $C_{20}H_{12}Br_2$ Perylene, 3,9-dibromo-, 1810^a.
 $C_{20}H_{12}Br_2HgO_2$ See *Mercurochrome*.
 $C_{20}H_{12}Cl_4$ Perylene, dichloro-, 1810^a.
 $C_{20}H_{12}Cl_4O$ Phenolphthalein, tetrachloro-, 800^a.
 $C_{20}H_{12}I_4O$ Phenolphthalein, tetraiodo-, 954^a.
 $C_{20}H_{12}N_2O_4$ Perylene, dinitro-, 1811^a, P 3371^a.
 $C_{20}H_{12}N_4O_4$ Quinoxaline, 2,3-bis(3,5-dinitrophenyl)-, 1983^a.
 $C_{20}H_{12}O$ 1,12-Fuoroperylene, 12597.
 $C_{20}H_{12}O$ Binaphthylene dioxide, 405^a.
 $C_{20}H_{12}BrO_4$ 4,3- β -Naphthopyran-1-*o*-benzoic acid, 2-bromo-3-keto-, 3616^a.
 $C_{20}H_{12}Br_2ClO_4$ Hydroquinol, 3,5-dibromo-2-chloro-, dibenzoate, 574^a.
 $C_{20}H_{12}ClO_4$ 13-Keto-13- α -meso-dibenzoxanthylum perchlorate, 405^a.
 $C_{20}H_{12}NO_2$ 5-Isodibenzophenoxazin-5-one, 240^a, 241^a.
 $C_{20}H_{12}N_2O_4$ $\beta\beta'$ -Dibenzophenazine, nitro-, 1795^a.
 $C_{20}H_{12}N_2O_4$ See *Perylene*.
 $C_{20}H_{12}BrNO_2$ Fluorene, 9-*m*-bromobenzal-2-nitro-, 3362^a.
 $C_{20}H_{12}Br_2NO_2$ 9-Phenanthrol, 2,7-dibromo-10-phenylazo-, 2895^a.
 $C_{20}H_{12}Br_2NO_4$ *o*-Toluic acid, α,α -bis(3-bromo-4-hydroxy-5-nitrophenyl)-, 404^a.
 $C_{20}H_{12}Br_2O_2S_2$ Phthalic acid, dithiol-, bis(β -bromophenyl) ester, 3192^a.
 $C_{20}H_{12}Br_2N_2O_4$ 2,2'-Bisiodoxy-, 5,7,5',7'-tetra-bromo-, diacetate, 892^a.
 $C_{20}H_{12}ClNO_2$ Fluorene, 9-*o*-chlorobenzal-2-nitro-, 3362^a.
 $C_{20}H_{12}ClNO_2S$ 5-Benzothiazolol, 4-chloro-1-phenyl-, benzoate, 2692^a.
 $C_{20}H_{12}Cl_2N_2O_4$ Benzamide, *N*, *N'*-*p*-phenylene-bis[2-chloro-5-nitro-, 232^a.
 $C_{20}H_{12}Cl_4N_2O_4$ 1,3-Benzodioxan, 6-(hydroxynaphthylazo)-2,4-bis(trichloromethyl)-, 233^a.
 $C_{20}H_{12}F_2O_4S_2$ 2-Naphthol-3,6-disulfonyl fluoride, naphtholsulfonate, 3605^a.
 $C_{20}H_{12}NO_2$ Fluorene, 9-*m*-iodobenzal-2-nitro-, 3362^a.
 $C_{20}H_{12}O_2S_2$ Phthalic acid, dithiol-, bis(iodo-phenyl) ester, 3192^a.
 $C_{20}H_{12}I_4O$ Resorcinol, 4,6-diiodo-, dibenzoate, 2671^a.
 $C_{20}H_{12}N_2O$ 5-Isodibenzophenoxazine, 5-imino-, and -HCl, 240^a, 241^a.
 $C_{20}H_{12}N_2O_4$ Ketiponitrile, α,δ -bis(3,4-methylenedioxypheyl)-, 1110^a.
 Mucononitrile, β,γ -dihydroxy- α,δ -bis(3,4-methylenedioxypheyl)-, 1110^a.
 $C_{20}H_{12}N_2O_4$ Quinoxaline, 2,3-bis(*m*-nitrophenyl)-, 1983^a.
 $C_{20}H_{12}N_4O_4$ Di-2-naphthylamine, 1,6,8-trinitro-, 404^a.
 1-Naphthylamine, *N*-(1,6,8-trinitro-2-naphthyl)-, 404^a.
 $C_{20}H_{12}NO_4$ *o*-Toluic acid, α,α -bis(4-hydroxy-3,5-dinitrophenyl)-, 404^a.
 $C_{20}H_{12}NO_4$ Benzil, 3,5,3',5'-tetranitro-, monophenyldiazone, 1963^a.
 $C_{20}H_{12}O_2$ Perylenediol, P 21371.
 $C_{20}H_{12}O_2$ 13(13a)- α -meso-Dibenzoxanthene, 13a hydroxy-, 405^a.
 1,2- α -Naphthopyrone, 3-benzoyl-, 378^a.
 1,4-Naphthoquinone, 2 (4-hydroxy-1-naphthyl), 2887^a.
 $C_{20}H_{12}O_4$ 1,3-Indandione, 2-(1-keto-3-methoxy-2-indenylmethylene)-, 3362^a.
 4,3- β -Naphthopyran-1-*o*-benzoic acid, 3-keto-, 3616^a.
 $C_{20}H_{12}O_4$ See *Fluorescein*.
 $C_{20}H_{12}O_4$ $\Delta^1(5)$ -*o*-Furanacetic acid, 3-hydroxy-5-keto- α,δ -bis(3,4-methylenedioxypheyl)-, 1110^a.
 $C_{20}H_{12}BrNO_2$ 7,8-Benzoquinoline, 6-bromo-2-methyl-, picrate, 969^a.
 $C_{20}H_{12}ClNO_2$ 7,8-Benzoquinoline, 4-chloro-2-methyl-, picrate, 967^a.
 $C_{20}H_{12}NO_2$ Fluorene, 9-benzal-2-nitro-, 3362^a.
 Phthalimide, *N*-(*p*-phenylphenyl)-, 26811^a.
 3-Pyranquinolone, 8-styryl-, 411^a.
 $C_{20}H_{12}NO_4$ 7,8-Benzoquinoline-2,4-diol, monobenzoate, 1987^a.
 $C_{20}H_{12}N_2$ 2,3-Benzo-5,6-phenanthro-1,4,7-hepta-triazine, 21327^a.
 $C_{20}H_{12}N_2O_2$ Anthraquinone, mono-*o*-nitrophenyl-hydrazone, 21333^a.
 Phenanthrenequinone, mono-*o*-nitrophenyl-hydrazone, 21334^a.
 $C_{20}H_{12}BrCl_2N$ 1-(1,5-Dichloro-9-anthrylmethyl)-pyridinium bromide, 12611^a.
 $C_{20}H_{12}Br_2O_4$ *o*-Toluic acid, α,α -bis(3-bromo-4-hydroxyphenyl)-, 404^a.
 $C_{20}H_{12}ClNO_2$ Acenaphthene, 3-(α -chlorostyryl)-4-nitro-, 1811^a.
 $C_{20}H_{12}CoO_4S_2$ + 6H₂O, 866^a.
 $C_{20}H_{12}N_2$ Acenaphthoquinoxaline, dimethyl-, 1045^a.
 $C_{20}H_{12}N_2O_2$ Acenaphthoquinoxaline, dimethoxy-, 1645^a, 1646^a.
 Pyrazinedione, dihydrodiphenyl-, 13291^a.
 Phthalimide, *N*-[*p*-(*p*-aminophenyl)-phenyl]-and -HCl, 28917^a; -H₂SO₄, 80^a.
 $C_{20}H_{12}N_2O_2$ Phthalimide, *N*-(7-acetamido-2-naphthyl)-, 28921^a.
 $C_{20}H_{12}NO_2S$ 3-Thiophenecarboxanilide, 4,5-dihydro-4-keto-5-(3-keto-2(3-indylidene)-2-methyl-, 734^a.
 $C_{20}H_{12}N_2O_4$ Fluorescein, hydrazide, 1983^a.
 $C_{20}H_{12}N_2O_4S$ Benzenesulfonic acid, *p*-(10-hydroxy-9-phenanthrylazo)-, 2895^a.
 $C_{20}H_{12}NO_4$ *o*-Toluic acid, α,α -bis(4-hydroxy-3-nitrophenyl)-, 403^a.
 $C_{20}H_{12}N_4$ Phenanthro-*o*-phenylenedihydrazone, 2132^a.
 $C_{20}H_{12}N_4O$ 2(1)-Isoquinolinenitrile, 1,1'-oxybis-, 26947^a.
 $C_{20}H_{12}N_2O_2$ Indole, 3-(*p*-nitrophenylazo)-2-phenyl-, 1263^a.
 $C_{20}H_{12}N_2O_4$ Benzil, *m,m'*-dinitro-, phenyl-hydrazone, 1983^a.
 $C_{20}H_{12}NO_2$ 5,6-Benzoquinoline, 1-methyl-, picrate, 971^a.
 $C_{20}H_{12}NO_4$ 3-Pyranquinolone, 8,10-dimethyl-, picrate, 411^a.
 $C_{20}H_{12}O_8$ 1,3-Benzodisulfone, 2-benzoyl-2-phenyl-, 72^a.

- C₂₀H₁₄O₂** 1,1'-Bi-2-naphthol, 405².
Glyoxal, 3-acenaphthenylphenyl-, 1811².
Phthalide, 2,2-diphenyl-, 911².
C₂₀H₁₄O₃ Phthalic acid, dithiol-, di-Ph ester, 3192⁴.
C₂₀H₁₄O₃ 1,4-Naphthalenediol, 2-(4-hydroxy-1-naphthyl)-, 2887^{2,4}.
C₂₀H₁₄O₄ (See also *Phenolphthalein*.)
4,3-β-Naphthopyran-1-*o*-benzoic acid, 1,2-dihydro-3-keto-, 3616².
C₂₀H₁₄O₅ Pyromellitic anhydride, tetralin addn. compd., 1455⁴.
C₂₀H₁₄O₅ Anthraquinone, 1,2,5-trihydroxy-, triacetate, 910¹.
C₂₀H₁₄BiN₂O₂ Bismuthine, triphenyl-, dicyanate, 1252⁴.
C₂₀H₁₄Br Ethylene, bromotriphenyl-, 3902².
C₂₀H₁₄BrN₂O₃S 4-Nitro-2-phenyl-1-*p*-tolylbenzothiazolium bromide, 2693².
C₂₀H₁₄BrO Ketone, 3-acenaphthenyl *α*-bromobenzyl-, 1811².
C₂₀H₁₄Cl Acenaphthene, 3-(*α*-chlorostyryl)-, 1811².
C₂₀H₁₄ClN₂O₃ Creosol, 6-chloro-*α* phenylimino-, picrate, 906².
C₂₀H₁₄ClO₄ Oxindirubin, 4-chloro-3,5,3',5'-tetramethyl-, 407².
C₂₀H₁₄ClO₄ 3-Benzyl-β-naphthopyrylium perchlorate(?), 408².
3-Methyl-2-phenyl-β-naphthopyrylium perchlorate(?), 408².
C₂₀H₁₄Cl₂NO₂ Acenaphthene, 3-(*α*,*α*-dichlorophenethyl)-4-nitro-, 1811⁴.
C₂₀H₁₄Cl₃ Ethane, 1,1,2-trichloro 1,2,2-triphenyl-, 3902².
C₂₀H₁₄I₂N₂O₂ Benzamide, *N*, *N'*-(2-iodo-*p*-phenylene)bis-, 2671².
C₂₀H₁₄NO Acetophenone, *α*-phenyl-*α*-phenylimino-, *SnCl₄* addn. compds., 3902¹.
Indole, 2-(*p*-phenoxyphenyl)-, 1262².
C₂₀H₁₄NO₂ 7-Acenaphthoquinolincarboxylic acid, 4,5,5a,6-tetrahydro-, 1123².
β-Butenic acid, *α*-2-naphthylimino *γ*-phenyl-, 2902².
Glyoxal, 3 acenaphthenylphenyl-, oxime, 1811².
2,3 - Pyrrolidinedione, 1 - (2-naphthyl)-5-phenyl-, 2902².
C₂₀H₁₄NO₂ Benzanilide, *p'* hydroxy-, benzoate, 1794².
Ketone, benzyl 4-nitro 3-acenaphthenyl-, 1811².
C₂₀H₁₄NO₄ 1,2-Benzacridine-7-carboxylic acid, 5,6-dihydro-2-hydroxy-, acetate, 1123².
C₂₀H₁₄N₂O₃Sb Stibine, triphenyl-, dicyanate, 1252⁴.
C₂₀H₁₄N₂ 2,3-Benzo 1,4,7-heptatriazine, 5,6-diphenyl-, 2132².
C₂₀H₁₄N₂O 2-Naphthol, 1-(2-methyl-3-quinolylozo)-, 2474².
C₂₀H₁₄N₂O₄ Benzamide, *N*, *N'* (4-nitro-*o*-phenylene)bis-, 2692¹.
C₂₀H₁₄N₂O₅ 1(2)-Anthracenone, 3,4-dihydro-, picrate, 1123².
C₂₀H₁₄N₂O₇S₂ 2,2'-Stilbenedisulfonic acid, *α*-hydroxy-4,4'-dinitro-, anhydride, Me ester, pyridine, deriv., 909².
C₂₀H₁₄N₂O 1,2,3-Benzotriazole, 5-acetamido-1-(3-carbazyl)-, 3198².
C₂₀H₁₄N₂O₄ Benzimidazole, 1-(4-anilino-3-nitrophenyl)-2-methyl-5-nitro-, 2691².
C₂₀H₁₄N₂O₄ 1,4-Imidazopyridin-2(3)-one, 3-benzyl-, picrate, 1265¹.
C₂₀H₁₆ 1,2-Benzanthrene, 9,11-dimethyl-, P 2478².
C₂₀H₁₆BeN₂O₄ 1,3-Butanedione, 1-(nitrophenyl)-, Be deriv., 3611².
C₂₀H₁₆BrClN₂O₇ Dibenzylamine, *p*-bromo-*p'*-chloro-, picrate, 53².
C₂₀H₁₆BrIN₂O₇ Dibenzylamine, *p*-bromo-*p'*-iodo-, picrate, 53².
C₂₀H₁₆Br Ethane, 1,2-dibromo-1,1,2-triphenyl-, 3902².
C₂₀H₁₆BrN₂O₄ Δ²-Pyrrolizinecarboxylic acid, 1-(2,4-dibromophenyl)-4,5-diketo-, butyl ester, 4 - (2,4 - dibromophenyl)hydrazone, 2890².
C₂₀H₁₆Br₂O Cyclopentenone, methylbis(3,4-methylenedioxyphenyl)-, tetrabromide, 576².
C₂₀H₁₆ClIN Benzimidazole, 1-(*p*-chlorophenyl)-2-methyl-5-phenylazimino-, 2691².
C₂₀H₁₆Cl₂N₂O₇ Dibenzylamine, dichloro-, picrate, 53², 54^{1,2}.
C₂₀H₁₆N₂O Benzil, monophenylhydrazone, *SnCl₄* addn. compd., 3902².
Glyoxal, 3 acenaphthenylphenyl-, hydrazone, 1811².
C₂₀H₁₆N₂O₂ α-Toluanilide, 2-hydroxy-*α*-phenylimino-, 1117
C₂₀H₁₆N₂O₂ Acenaphthoquinone, 1,6-dimethoxy-, phenylhydrazone, 1640¹.
1,2-Benzacridine-7-carboxylic acid, 2 acetamido-5,6 dihydro-, 1123².
Indigotin, 1-acetyl-7,7'-dimethyl-, 881².
Phthalimide, *N* [β-(2 acetyl-3 indyl)ethyl]-, 1270¹.
Protocatechualdehyde, benzoate, phenylhydrazone, 1108¹.
C₂₀H₁₆N₂O₃S *p*-Benzenesulfenotoluide, 2 benzoyl 4-nitro-, 2693².
C₂₀H₁₆N₂O₄ Ketiponitrile, *α*, *δ*-di-*o* anisyl, 1110⁴.
Mucononitrile, *α*, *δ* di-*o* - anisyl - *β*, *γ* - dihydroxy-, 1110⁴.
C₂₀H₁₆N₂O₃S Phenol, *p*-(*p*-tolylsulfonylazo)-, benzoate, 68².
C₂₀H₁₆N₂O₃S₂ Benzisosulfonazole, 1 benzyl-1,2-dihydro 2 (phenylsulfonylimino)-, 2888².
C₂₀H₁₆N₂O₂ Methazonic acid, dibenzoyl, di-Ac deriv., 1099².
C₂₀H₁₆N₂S₂ Disulfide, bis(2-methylthio-3 indolecarboxyl), 1460².
C₂₀H₁₆N₄ 2,1,3-Benzotriazole, 5-benzalamino-2-*p*-tolyl-, 2689².
C₂₀H₁₆N₄O 3-Quinololinol, 2-methyl-4-(2 methyl-3-quinolylozo)-, 2474².
C₂₀H₁₆N₄O₂ Di-2-naphthylamine, 1,2,3,4 tetrahydro-1',6',8',trinitro-, 404².
C₂₀H₁₆N₄O Benzisoquinoline, dihydromethyl-, picrate, 972².
C₂₀H₁₆N₄O 1,2,3-Benzotriazole, 5-acetamido-1-phenyl-4-phenylazo-, 2690².
C₂₀H₁₆N₄O₂ Benzimidazole, 5-(*p*-nitrophenylazimino)-1-*p*-tolyl-, 2691².
C₂₀H₁₆N₄O₂ 5-Isoindazolol, 1-acetyl-4-(1-acetyl-5-isoinidazolylazo)-, acetate, 2693².
C₂₀H₁₆N₄O₂ 1,2,4-Triazole, 3,5-dimethyl-1-naphthyl-, picrate, 3201¹.
C₂₀H₁₆O Ketone, 3-acenaphthenyl benzyl, 1811².
C₂₀H₁₆O₂ Acetic acid, triphenyl-, 1482².
Ketone, 3-acenaphthenyl *α*-hydroxybenzyl, 1811⁴.
C₂₀H₁₆O₂ 7-*meso*-Benzanthrenone, 4,10,11-trimethoxy-, 2894².
Oxidirubin, 3,5,3',5'-tetramethyl-, 407².
Spiro[cyclopropane - 1,2' - indan] - 2 - car-

- boxylic acid, 1',3'-diketo-3-phenyl-, Et ester, 3203^a.
- o*-Toluic acid, α , α -bis(*p*-hydroxyphenyl)-, salts, 403^a.
- $C_{20}H_{11}O_4S$ Benzoin, benzenesulfonate, 1802^a.
- $C_{20}H_{11}O_4$ Cyclopentenone, methylbis(3,4-methylenedioxyphenyl)-, 576^a.
- 3-Pentadienone, 2-methyl-1,5-bis(3,4-methylenedioxyphenyl)-, 576^a.
- $C_{20}H_{11}O_6$ *p*-Coumaric acid, *p*-coumarate, acetate, 1257^a.
- $C_{20}H_{11}O_7$ Flavone, 3,7-dihydroxy-4'-methoxy-, diacetate, 93^a.
- $\Delta^2(6)$, α -Furanacetic acid, α ,4-di-*o*-anisyl-3-hydroxy-5-keto-, 1110^a.
- Isoflavone, 5,7,4'-trihydroxy-2-methyl-, diacetate, 246^a.
- $C_{20}H_{17}BF_2N$ Nitroborofluoride, 1235^a.
- $C_{20}H_{17}ClN_2O_2$ Vanillin, chloro-, diphenylhydrazone, 906^a.
- $C_{20}H_{17}ClN_2O_7$ Dibenzylamine, *p*-chloro-, picrate, 53^a.
- $C_{20}H_{17}ClO_2$ Δ^2 -Cyclohexenone, 3-[*o*(*m* and *p*)-chlorostyryl]-5-sulcyl-, 2258^a,^b.
- $C_{20}H_{17}ClO_7$ 2-(α -11-hydroxy- α -methylstyryl)benzopyrylium perchlorate(?), acetate, 107^a.
- 2-(α -Hydroxystyryl)-3-methylbenzopyrylium perchlorate(?), acetate, 407^a.
- $C_{20}H_{17}Cl_2OP$ Phosphine, dichloro(diphenyl-*p*-tolylmethoxy)-, 67^a.
- $C_{20}H_{17}Cl_2O_2P$ Phosphine, [*m*(and *p*)-anisyl-diphenylmethoxy]dichloro-, 66^a, 67^a.
- $C_{20}H_{17}N$ Benzylamine, *N*-diphenylmethylene-, 3901^a.
- $C_{20}H_{17}NO$ Ketone, 3-acenaphthenyl benzyl, oxime, 1811^a.
- $C_{20}H_{17}NO_2$ Anisamide, *N*,*N*-diphenyl-, 3190^a.
- Anisimide acid, *N*-phenyl-, Ph ester, 3190^a.
- 1,2-Benzacridine-7-carboxylic acid, 5,6-dihydro-5,6-dimethyl-, 1123^a.
- , 6-ethyl-5,6-dihydro-, 1123^a.
- Benzanilide, *N*-phenyl-, 3190^a.
- Benzimidic acid, *N*-*p*-anisyl-, Ph ester, 3190^a.
- , *N*-phenyl-, anisyl ester, 3190^a.
- 2(1)-Benzofuraneone, 1,4-dimethyl-1-[1(and 2)-naphthylamino]-, 911^a.
- Benzoin, α -phenyl-, oxime, 3356^a.
- Ketone, β -anilino-propenyl 1-hydroxy-2-naphthyl, 2472^a.
- $C_{20}H_{17}NO_4$ (See also *Berberine*.)
- 3-Quinolonebutyric acid, 4-carboxy 2-phenyl-, 2695^a.
- $C_{20}H_{17}NO_4S$ Naphtholsulfonic acid, naphthylamine salt, 1646^a, 3361^a.
- $C_{20}H_{17}NO_4$ Oxyberberine, 1988^a.
- $C_{20}H_{17}NO_4$ 5(4)-Oxazolone, 4-(5-hydroxyveratral)-2-phenyl-, acetate, 78^a.
- $C_{20}H_{17}NO_4U$ Aniline disalicylatouranate, 2231^a.
- $C_{20}H_{17}NO_4S$ Benzyl alcohol, 3,4,5-trihydroxy-, tris(methyl carbonate) *p*-nitrobenzoate, 2886^a.
- $C_{20}H_{17}N_2O$ Diimide, α -carbamy- β -triphenylmethyl-, 1455^a.
- $C_{20}H_{17}N_2O_2$ Acetanilide, *p*-(*p*-*o*-nitroanilino)-phenyl]-, 913^a.
- $C_{20}H_{17}N_2O_3$ $\Delta^2(6)$, α -Furanacetic acid, 4,5-dihydro-3,5-diketo- α ,4-diphenyl-, Me ester, semicarbazone, 1110^a.
- $C_{20}H_{17}N_2O_3$ Pseudoisatin, 1-hydroxy-, bisphenylhydrazone, 2127^a.
- $C_{20}H_{17}N_2O_4$ Acetanilide, 3,5-dianilino-2,4-dinitro-, 3606^a.
- $C_{20}H_{19}BaO_4$ 1,3-Butanedione, 1-phenyl-, Ba deriv., 3357^a.
- $C_{20}H_{19}Br_2N_2O_4$ Succinic acid, diketo-, diethyl ester, 2,4-dibromophenylosazone, 2899^a.
- $C_{20}H_{19}CaO_4$ 1,3-Butanedione, 1-phenyl-, Ca deriv., 3357^a.
- $C_{20}H_{19}ClN_2O_2$ Isobenzophenoxazine, 5-acetamidomethylimino-, methochloride, 743^a.
- $C_{20}H_{19}MgO_4$ 1,3-Butanedione, 1-phenyl-, Mg deriv., 3357^a.
- $C_{20}H_{19}N_2$ 1(2) Anthracenone, 3,4-dihydro-, phenylhydrazone, 1123^a.
- $C_{20}H_{19}N_2O_2$ Acetic acid, triphenyl, hydrazide, 1455^a.
- 1,2-Benzacridine, 7 (acetamidomethyl) 5,6-dihydro-, 1122^a.
- $C_{20}H_{19}N_2O_2$ 1,2-Benzacridine-7-carboxylic acid, 2-dimethylamino-5,6-dihydro-, 1123^a.
- 5- γ -Isobenzophenoxazin-5-one, 9-dimethylamino-, 744^a.
- $C_{20}H_{19}N_2O_2S$ Carbazole, 3-(*N*-methyl-*p*-tolylsulfonamido)-, 3199^a.
- $C_{20}H_{19}N_2O_4$ 1,2-Benzacridine-7-carboxylic acid, 5,6-dihydro-2-(β -hydroxyethylamino)-, 1123^a.
- 1-Imidazolacetic acid, 4-benzal-4,5-dihydro-5-keto-2-phenyl-, Et ester, 1813^a.
- $C_{20}H_{19}N_2O_4S$ *p*-Toluenesulfonanilide, *N*-methyl-2'-nitro-4'-phenyl-, 2680^a.
- $C_{20}H_{19}N_2O_4S_2$ 1,5-Naphthalenedisulfonic acid, pyridine addn. compd., 573^a.
- $C_{20}H_{19}N_2O_7$ Ketone, 4,5-methylenedioxy-2-nitrophenyl 1,2,3,4-tetrahydro-2,3-dimethyl-6,7-methylenedioxy-1-isquinolyl-, 1900^a.
- $C_{20}H_{19}N_2O_4S_2$ *m*-Benzenedisulfonyl chloride, 4,5-dihydroxy-*N*,*N'*-dimethyl-, sulfate, 72^a.
- $C_{20}H_{19}N_2O_4$ Benzaldehyde, 4 diphenylaminosemicarbazone, 69^a.
- $C_{20}H_{19}N_2O_4S_2$ Hydantoin, 5,5'-dithiodimethylenebis(3-phenyl-, 3183^a.
- $C_{20}H_{19}N_2O_7$ Benzoquinoline, 1,2,3,4-tetrahydro-methyl-, picrate, 967^a, 971^a.
- $C_{20}H_{19}N_2O_8$ Benzylhydroxymethylphenylammonium picrate, 65^a.
- $C_{20}H_{19}N_4$ 1,2,3-Benzotriazole, 4,7-dimethyl-1-phenyl-5-phenylazimino-, 2690^a.
- $C_{20}H_{19}O$ Cyclohexanone, 2,6-dibenzal-, 231^a.
- Ether, benzohydryl tolyl, 3613^a.
- $C_{20}H_{19}O_3$ 3-Furanol, 2,5-ditolyl-, acetate, 82^a.
- $C_{20}H_{19}O_4$ Benzene, 1,4-dimethoxy-2,5-diphenoxy-, 3605^a.
- Cyclopentenone, (*p*-anisyl)methyl(3,4-methylenedioxyphenyl)-, 576^a.
- $C_{20}H_{19}O_4Br$ 1,3-Butanedione, 1-phenyl-, Sr deriv., 3357^a.
- $C_{20}H_{19}O_4$ Chalcone, 4'-acetyl-4-hydroxy-3-methoxy-, acetate, 2272^a.
- $C_{20}H_{19}O_4$ Sinomenol, di-Ac deriv., 1656^a.
- $C_{20}H_{19}O_4S_2$ Hydroquinone, bis(*p*-toluenesulfonate), 68^a.
- , 2-(*p*-tolylsulfonyl)-, mono-*p*-toluenesulfonate, 68^a.
- $C_{20}H_{19}O_7$ Flavone, 7-hydroxy-3,3',4'-trimethoxy-, acetate, 93^a.
- Umbelliferone, 4-(3,4,5-trimethoxyphenyl)-, acetate, 1981^a.
- $C_{20}H_{19}O_8$ Biphenyl, 2,4,2',5'-tetrahydroxy-, tetraacetate, 2887^a.
- $C_{20}H_{19}Br_2N_2O_4$ Homopiperonylonitrile, 6-[(bromohomopiperonyl)methylamino]methyl]-, and salts, 1270^a.
- $C_{20}H_{19}ClN_2O_2$ Isobenzophenoxazine, (ethyl imino)-, ethochloride, 744^a.

- C₂₀H₁₉ClN₂O₂ Compd., m. 230°, from *N,N'*-diacetyl-4'-chloro-4,5-dimethoxy-2,2'-stilbenediamine and POCl₃, 580°.
- C₂₀H₁₉ClO₄ 2-Methyl-4,6-di-*p*-tolylpyrylium perchlorate, 1813°.
- C₂₀H₁₉N Ethylamine, β -triphenyl-, and salts, 2670°, 2671°.
- C₂₀H₁₉NO Carbazole, 9-benzoyl-1,2,3,4-tetrahydro-6-methyl-, 91°.
- C₂₀H₁₉NO₂ 3-Quinolonebutyric acid, 2-phenyl-, Me ester, 2695°.
- C₂₀H₁₉NO₃ 2-Pyranobenzoquinolone, 8-acetyl-5,6,7,8-tetrahydro-4,7-dimethyl-, 411°.
- 4(3)-Quinolone, 3,3-diethyl-2-hydroxy-, benzoate, 1987°.
- C₂₀H₁₉NO₃S Benzenesulfonamide, *N*-(β -hydroxy- β , β -diphenylethyl)-, 568°.
- C₂₀H₁₉NO₃S Di- α -toluenesulfonamidyl-, 99°.
- C₂₀H₁₉NO₃ Protopine, 1270°.
- C₂₀H₁₉N₂O₂P Phosphamidine, *o* phenylene[*N*-ditolyl]-, 3057°.
- C₂₀H₁₉NO₃ 5- γ -Isobenzophenoxazine, 9-diethylamino-5-imino-, 744°.
- Semicarbazide, 1-triphenylmethyl-, 1455°.
- C₂₀H₁₉N₂O₂ Hydrazine, β -(α -nitromethylbenzyl)- α , α -diphenyl-, 2253°.
- p*-Phenylenediamine, *N*-(α -nitromethylbenzyl)-*N*-phenyl-, 2253°.
- C₂₀H₁₉N₂O₂ 2-Naphthol, 1-(6-nitrocarvacrylazo)-, 903°.
- Phthalimide, *N*-(δ , ϵ -diketoheptyl)-, δ -phenylhydrazine, 1269°.
- C₂₀H₁₉N₂O₂ Pyrimidine, 4-methyl-6-(*N*-methylanilino)-2-phenyl-, hydrogen oxalate, 97°.
- C₂₀H₁₉N₂O₃S Naphtholsulfonic acid, (6-nitrocarvacrylazo)-, 903°.
- C₂₀H₁₉OP Phosphine oxide, dibenzylphenyl-, 66°.
- C₂₀H₁₉O₂P Methanephosphonic acid, diphenyl-*p*-tolyl-, and *di-K* salt, 67°.
- C₂₀H₁₉O₂P Methanephosphonic acid, anisyl-diphenyl-, 66°, 67°.
- C₂₀H₂₀AgBF₄N₄, 1235°.
- C₂₀H₂₀B₂CuF₂N₄, 868°, 1235°.
- C₂₀H₂₀Br₂CoN₄, 1235°, 2232°.
- C₂₀H₂₀Br₂FeN₄, 2232°.
- C₂₀H₂₀Br₂N₂O₄ 1,2-Pyridazinedicarboxylic acid, 4,5-dibromo-3,4,5,6-tetrahydro-3,6-diphenyl-, di Me ester, 1124°.
- C₂₀H₂₀Br₂N₂O₄S 5-Benzothiazolecarboxylic acid, 1-amino-, Et ester, tribromide, 2688°.
- C₂₀H₂₀CdCl₂N₂O₄, 2232°.
- C₂₀H₂₀ClFN₂O₄S₂ 1-Naphthalenesulfonyl chloride 1,2,3,4-tetrahydro-?-nitro-, addn. compd. with 1,2,3,4-tetrahydro-?-nitro-1-naphthalenesulfonyl fluoride, 3604°.
- C₂₀H₂₀ClN₂ See *Rosaniline*.
- C₂₀H₂₀ClN₂O₄ Phthalamic acid, *N*-(δ , ϵ -diketoheptyl)-, δ -(*m*-chlorophenyl)hydrazine, 1269°.
- C₂₀H₂₀Cl₂CoN₄, 1235°, 2231°.
- C₂₀H₂₀Cl₂CoN₄O₄, 2231°.
- C₂₀H₂₀Cl₂CuN₄O₄, 2232°.
- C₂₀H₂₀Cl₂MnN₄O₄, 2232°.
- C₂₀H₂₀Cl₂N₂IO₄, 2232°.
- C₂₀H₂₀Cl₂N₂O₄Zn, 2232°.
- C₂₀H₂₀Cl₂N₂Pt, 2850°.
- C₂₀H₂₀CoI₂N₄, 2232°.
- C₂₀H₂₀FeI₂N₄, 2232°.
- C₂₀H₂₀FeN₂O₄S, 2232°.
- C₂₀H₂₀Ge Germane, ethyltriphenyl-, 3897°.
- C₂₀H₂₀N₂ Indole, 3,3'-ethylenebis[2-methyl-, 87°.
- C₂₀H₂₀N₂O₂ Acrylophenone, β , β' -dimethylhydrazobis-, 1450°.
- Resorcinol, 4,6-bis(*p*-aminobenzyl)-, 3615°.
- C₂₀H₂₀N₂O₂ Benzidine, *N,N'*-dimethylsuccinyl-, acetyl deriv., 2891°.
- C₂₀H₂₀N₂O₂ Glycine, *N*-(α -benzamidocinnamyl)-, Et ester, 1813°.
- Homopiperonylonitrile, 6-[(homopiperonylmethylamino)methyl]-, and *HNO*, 1270°.
- 1,2-Pyridazinedicarboxylic acid, 3,6-dihydro-3,6-diphenyl-, di-Me ester, 1124°.
- C₂₀H₂₀N₂O₂ Tyrosine, *N*-(α -acetamidocinnamyl)-, 614°.
- C₂₀H₂₀N₂O₂ Hydrohydrastinine, 3-methyl-1-(6-nitropiperonyl)-, 1990°.
- C₂₀H₂₀N₂O₂S Cystine, dibenzoyl-, 3185°.
- C₂₀H₂₀N₂O₂ Acetoacetic acid, α , α -bis(*p*-nitrobenzyl)-, Et ester, 3611°.
- C₂₀H₂₀N₂O₂S 1-Propanol, 3,3'-thiobis-, bis(*p*-nitrobenzoate), 1630°.
- C₂₀H₂₀N₂O₂ Ketone, isobutenyl 6-isobutenyl-3-pyridyl-, picrate, 2130°.
- C₂₀H₂₀N₂O₂S₂ 1,2,4-Triazol-5(4)-one, 3,3'-dithio-bis[4-xylyl]-, 2900°.
- C₂₀H₂₀N₂ 1,2,4-Triazole, *ar,ar'*-azobis[3,5-dimethyl-1-phenyl]-, 3200°.
- C₂₀H₂₀O₂ Cyclohexanone, 2-benzal-6-(α -hydroxybenzyl)-, 2311°.
- C₂₀H₂₀O₂ 3-Pentadecanone, 1,5-di-*m*-anisyl-2-methyl-, 1803°.
- C₂₀H₂₀O₄ 1,2-Cyclohexanediol, dibenzoate, 572°.
- C₂₀H₂₀O₄ Metaligin, 2475°.
- C₂₀H₂₀O₄ Coumarin, 5,7-dimethoxy-4-(3,4,5-trimethoxyphenyl)-, 1981°.
- Flavone, 3,5,7,3',4'-pentamethoxy-, 1120°.
- C₂₀H₂₀O₄ Glucuronic acid, diphenylacetyl-, 947°.
- C₂₀H₂₁ClN₂O₄ 2,2'-Stilbenediamine, *N,N'*-diacetyl-4'-chloro-4,5-dimethoxy-, 580°.
- C₂₀H₂₁N Acetonitrile, cyclohexyldiphenyl-, 571°.
- C₂₀H₂₁NO Camphor, 3-(1-naphthylimino)-, 2266°.
- Chalcone, α -1-piperidyl-, 3051°.
- C₂₀H₂₁NO₂ Camphor, 3-(4-hydroxy-1-naphthylimino)-, 2266°.
- C₂₀H₂₁NO₂ Homotrilobine, 2690°.
- C₂₀H₂₁NO₂ (See also *Domesticine*: *Papaverine*.) Domesticine, Me ether, 2336°, 3368°, 3970°.
- Epidicentrine, 3368°, 3708°.
- Icodicentrine, 3368°.
- Pseudopapaverine, 1125°.
- C₂₀H₂₁NO₂ Morphine, acetyl, *N*-oxide, 384°.
- C₂₀H₂₁NO₂ Homopiperonylic acid, 6-[(homopiperonylmethylamino)methyl]-, 1270°.
- C₂₀H₂₁N₂O₂ Phthalamic acid, *N*-(δ , ϵ -diketoheptyl)-, δ -phenylhydrazine, 1269°.
- C₂₀H₂₁N₂O₂ Picrate, m. 138°, of base from BzCH₂CN and piperidine, 2902°.
- C₂₀H₂₁AsClN₂O₂ Quinine, arsinosochloro-, 1462°.
- C₂₀H₂₁BrNO Propiophenone, α -bromo- β -phenyl- α -1-piperidyl-, 3051°.
- C₂₀H₂₁ClN₂O₂ Codeine, trichloroacetate, 3905°.
- C₂₀H₂₁N₂O + H₂O Δ^1 -Cyclohexenol, 6-anilino-1,3-dimethyl-4-phenylimino-(?), 2124°.
- C₂₀H₂₁N₂O₂ Hydrazine, α , β -dibenzoyl- α -cyclohexyl-, 1802°.
- 2(1)-Pyrimidone, 4,6-epoxy-5,5-diethyltetrahydro-4,6-diphenyl-(?), 3351°.
- C₂₀H₂₁N₂O₂ Nipecotic acid, 1-nitroso-4,6-diphenyl-, Et ester, 906°.
- C₂₀H₂₁N₂O₂ Acetamidine, *N,N'*-bis(*p*-carboxyphenyl)-, di-Et ester, and *HCl*, 236°.
- Lysuric acid, 568°.
- 2,5-*p*-Piperazinedione, 1,4-di-*p*-phenetyl-, 2256°.

- $C_{20}H_{25}N_5O_5$** Naphthionic acid, *N*-acetyl-, xylidine salt, 3361⁹.
- $C_{20}H_{25}N_5O_2$** Homopiperonylamide, 6-[(homopiperonylmethylamino)methyl]-, 1270⁹.
- $C_{20}H_{25}N_5O_2$** Hydrohydrastinine, 1-(5-methoxy-2-nitrobenzyl)-3-methyl-, 1990².
- $C_{20}H_{25}N_5O_2$** Tyrosine, *N*-(*N*-acetyl- β -phenylalanyl)-, 614¹.
- $C_{20}H_{25}N_5O_2$** Δ^2 -Cyclohexenone, 5-amino-4-hydroxy-2,4-dimethyl-(?), *p*-nitrophenylhydrazones, 2124⁸.
- $C_{20}H_{25}N_5O_2$** Benzamide, *N*, *N'*-1,4-butylenebis[*N*-methyl-*m*-nitro-, 1964⁸.
- $C_{20}H_{25}N_5O_2$** Bornylamine, *N*-(1,6,8-trinitro-2-naphthyl)-404⁸.
- $C_{20}H_{25}N_5O_2$** Camphanilamine, *N*-(1,6,8-trinitro-2-naphthyl)-, 404⁸.
- $C_{20}H_{25}N_5O_2$** Cystine, *N*, *N'*-bis(phenylcarbonyl)-, 3185⁹.
- $C_{20}H_{25}N_5O$** Acetaldehyde, cyclohexyldiphenyl-, 571⁸.
- $C_{20}H_{25}N_5O$** Acetophenone, α -cyclohexyl- α -phenyl-, 571⁸.
- $C_{20}H_{25}N_5O$** —, hexahydro- α , α -diphenyl-, 571⁸.
- $C_{20}H_{25}N_5O$** 1,2-Pyran, 3,4-dihydro-2-methoxy-3,3-dimethyl-4,6-diphenyl-, 3044⁷.
- $C_{20}H_{25}N_5O$** Cyclohexanone, 2,6-bis(α -hydroxybenzyl)-, 2311¹.
- $C_{20}H_{25}N_5O$** 3-Heptanone, 7-(3,4-dimethylenedioxyphenyl)-1-phenyl-, 2125⁸.
- $C_{20}H_{25}N_5O$** Phenanthrene, dihydrotetramethoxyvinyl-, 1650³.
- $C_{20}H_{25}N_5O_3$** *p*-Toluic acid, α , α' -thiobis-, di-Et ester, 3890¹.
- $C_{20}H_{25}N_5O_3$** Acrylic acid, β -(2,4-dimethoxyphenyl)- β -(3,4,5-trimethoxyphenyl)-(?), 1981².
- $C_{20}H_{25}N_5O_3$** Phenetole, 2,2'-(β -trichloroethylidene)bis[4-methyl-, 2341¹.
- $C_{20}H_{25}N_5O$** Acetaldehyde, cyclohexyldiphenyl-, oxime, 571⁸.
- $C_{20}H_{25}N_5O$** Acetophenone, hexahydro- α , α -diphenyl-, oxime, 571⁸.
- $C_{20}H_{25}N_5O$** Benzotoluide, *N*-cyclohexyl-, 1102^{4,8}.
- $C_{20}H_{25}N_5O$** as-Homotetrahydroisoquinoline, benzoyl-8-isopropyl-, 1461⁸.
- $C_{20}H_{25}N_5O_2$** Nicotinic acid, 4,6-diphenyl-, Et ester, 906⁸.
- $C_{20}H_{25}N_5O_2$** Butyric acid, γ -benzoyl- α -methylamino- β -phenyl-, Et ester, and -HCl, 906⁸.
- $C_{20}H_{25}N_5O_2$** Guaiacol, 6-allyl-4-propyl-, carbanilate, 721¹.
- $C_{20}H_{25}N_5O_2$** o-Isoeugenol, 4-propyl-, carbanilate, 721¹.
- $C_{20}H_{25}N_5O_4$** Columbamine, tetrahydro-, 1654⁸.
- $C_{20}H_{25}N_5O_4$** Corypalmine, 1654⁸.
- $C_{20}H_{25}N_5O_4$** Jatrorrhizine, tetrahydro-, 1654⁸.
- $C_{20}H_{25}N_5O_4$** Homopiperonylamide, *N*-(β ,3,4-trimethoxyphenethyl)-, 1462⁴.
- $C_{20}H_{25}N_5O_4$** Sekisanine, diacetate, 3622⁸.
- $C_{20}H_{25}N_5O$** Benzaldehyde, 2-cyclohexyl-4-phenyl semicarbazone, 1802⁸.
- $C_{20}H_{25}N_5O_2$** Benzaldehyde, nitro-, cyclohexyltolylhydrazones, 1102⁹.
- $C_{20}H_{25}N_5O_2$** Cinchonine cyanide, *py*- α -hydroxy-, and di-HBr, 3055⁹.
- $C_{20}H_{25}N_5O_2$** Isobutyrophenone, α -hydroxy-2,5-dimethyl-, acetate, *p*-nitrophenylhydrazones, 3611⁷.
- $C_{20}H_{25}N_5S$** Benzaldehyde, 2-cyclohexyl-4-phenylthiosemicarbazone, 1802⁸.
- $C_{20}H_{25}Br_2O_2$** Phenetole, 2,2'-(β , β -dibromoethylidene)bis[4-methyl-, 2341¹.
- $C_{20}H_{25}IN$** Cyclohexylamine, *N*-diphenylmethylen-, methiodide, 3901⁸.
- $C_{20}H_{25}INO_2$** Dehydroisomenine, methiodide, 1656⁸.
- $C_{20}H_{25}N_2$** Acetophenone, cyclohexylphenylhydrazones, 1102⁹.
- $C_{20}H_{25}N_2O$** Benzoic acid, cyclohexyltolylhydrazones, 1102⁹.
- $C_{20}H_{25}N_2O_2$** (See also *Quinidine*; *Quinine*.)
- $C_{20}H_{25}N_2O_2$** *p*, *p'*-Bibutylanilide, 2884⁸.
- $C_{20}H_{25}N_2O_2$** Δ^2 -1,4-Cyclohexenediol, 1,5-dianilino-2,4-dimethyl-(?), 2124⁸.
- $C_{20}H_{25}N_2O_2$** Hydrocinnamic acid, β -(α -formylisopropyl)- α -methyl-, phenylhydrazide, 3044⁸; phenylhydrazones, 3044⁸.
- $C_{20}H_{25}N_2O_2$** *p*-Phenetidine, *N*, *N'*-dimethylacetylenebis-, 1973¹.
- $C_{20}H_{25}N_2O_2$** Benzoic acid, *p*-(α -*p* phenetyl)amino-, Et ester, and -HCl, 2364^{4,8}.
- $C_{20}H_{25}N_2O_2$** Isosoyhimboic acid, 413², 414¹.
- $C_{20}H_{25}N_2O_2$** Cotarnoline, sulfate, 1989⁹.
- $C_{20}H_{25}N_2O_2$** Biurea, α -cyclohexyl- β , β' -diphenyl-, 1802⁹.
- $C_{20}H_{25}N_2O_2$** 2-Butene, 2,3-bis(*p*-phenetylazo)-, 1973¹.
- $C_{20}H_{25}N_2O_2$** Hydrazine, β -carbonyl- α -ethyl- α -tolyl-, dimer, 2899⁸.
- $C_{20}H_{25}N_2O_2$** Acetamide, α , α' -nitrosoiminobis[*N*-phenethyl-, 1657⁷.
- $C_{20}H_{25}N_2O_4$** Dehydroisomenine, semicarbazones, 1655⁹.
- $C_{20}H_{25}N_2O_5$** Glycine, *N*- δ -phenylbutyl-, Et ester, picrate, 2696².
- $C_{20}H_{25}N_2O_5$** Pyrrolidine, 2,5-bis(hydroxymethyl)-1-*p*-methylbenzyl-, picrate, 412⁹.
- $C_{20}H_{25}N_2O_{10}$** [γ -(4-Acetamido-3-nitrophenyl)propyl]trimethylammonium picrate, 2254⁴.
- $C_{20}H_{25}O_2$** Hydrotoluenol, α -cyclohexyl-, 5714¹.
- $C_{20}H_{25}O_2$** Pyran, tetrahydro-2-methoxy-3,3-dimethyl-4,6-diphenyl-, 3044⁷.
- $C_{20}H_{25}O_2$** Stilbene, 2,4,6,3',4'-pentamethoxy- α' -methyl-, 1120⁹.
- $C_{20}H_{25}O_2$** Epicatechol, pentamethyl-, 1120⁹.
- $C_{20}H_{25}O_2$** Nodakenin, 1817⁹.
- $C_{20}H_{25}O_{10}$** Glucoside, triacetyl-6-benzoyl- β -methyl-, 63⁷.
- $C_{20}H_{25}NO_2$** Glycolamide, *N*, *N*-diethyl- α , α' -di-tolyl-, 2888⁸.
- $C_{20}H_{25}NO_2$** Isobutyramide, *N*, *N*-diethyl- α -hydroxy- β , β -diphenyl-, 2888⁸.
- $C_{20}H_{25}NO_2$** Benzamide, *N*-(α -acetylbenzyl)-, di-Et acetal, 75⁷.
- $C_{20}H_{25}NO_2$** (See also *Laudanidine*; *Laudanine*.)
- $C_{20}H_{25}NO_2$** Anhydroisomenine, *N*-methyl-, 1656¹.
- $C_{20}H_{25}NO_2$** Codamine, 1125⁴.
- $C_{20}H_{25}NO_2$** Porphyrone, Me ether, and chloroplatinate, 589⁸, 589⁴.
- $C_{20}H_{25}NO_3S$** Glycine, *N*-(γ -*p*-cumenylpropyl)-*N*-(phenylsulfonyl)-, 1461².
- $C_{20}H_{25}NO_3S$** —, *N*- ϵ -phenylamyl-*N*-*p*-tolylsulfonyl-, 2696².
- $C_{20}H_{25}NO_3$** Acetamide, α , α' -iminobis[*N*-phenethyl-, and -HCl, 1657⁷.
- $C_{20}H_{25}NO_3$** Base from dihydrocodeinone, perchlorate, 2698¹.
- $C_{20}H_{25}N_2O_2$** Urea, α -[β -(hydroxymethyl)- α -methylisobutyl]- β -phenyl-, carbanilate, 3347⁸.
- $C_{20}H_{25}N_3S$** Acetonitrile, bis(*p*-dimethylamino-phenyl)(ethylmercapto)-, 403⁹.
- $C_{20}H_{25}N_3S$** Thionine, tetraethyl-, 1283⁹.
- $C_{20}H_{25}N_3O_2$** 2,5-Piperazinedione, 1,4-dimethyl-, addn. compd. with 4-*o*-tolylazo-*o*-toluidine, 68⁷.
- $C_{20}H_{25}N_3O_2$** Putrescine, *N*-(1,2,3,4-tetrahydro-2-naphthyl)-, picrate, 566⁸.

- C₂₀H₂₅N₅O₈** [γ -(*p*-Acetamidophenyl)propyl]trimethylammonium picrate, 2254⁴.
- C₂₀H₂₅ClINO₂** Porphyroxine, methochloride, 588².
- C₂₀H₂₅INO₂** Porphyroxine, methiodide, 589².
- C₂₀H₂₅IN₂O₂** Methiodide of dinitrile from dihydrocodeinone, 2698¹.
- C₂₀H₂₅N₂** Piperazine, 2,3-dimethyl-1,4-di-*p*-tolyl-, and di-*HCl*, 1809⁹.
- C₂₀H₂₅N₂O** Benzamide, *N*-(ϵ -phenethylamino amyl)-, 566⁷.
- C₂₀H₂₅N₂O₂** (See also *Hydroquinine*.) Butyramidine, *N*, *N'*-di-*p*-phenetyl-, 236⁵. Yohimbyl alcohol, and -*HCl*, 3906².
- C₂₀H₂₅N₂O₂** Yohimboic acid, dihydro-, 414¹.
- C₂₀H₂₅N₂O₂** Porphyroxine, Me ether, oxime, 589⁴.
- C₂₀H₂₅N₂O₂** α -Glucoseptose, benzylphenylhydrazine, 2879⁸.
- C₂₀H₂₅N₂O₂** Biacetanilide, bis(dimethylamino)-, 238². Biacetyl, *p*-phenetylosazone, 1973³.
- C₂₀H₂₅N₂O₄** Porphyroxine, semicarbazone, 589¹.
- C₂₀H₂₅N₂O₄** Ethylenebis(trimethylammonium picrate), 2600⁶.
- C₂₀H₂₅N₂O₄** Piperazine, 1,4-bis(β -aminoethyl)-, dipicrate, 566⁸.
- C₂₀H₂₅O₂** Bithymol, 1453⁸.
- C₂₀H₂₅O₂S** Sulfide, bis(γ -benzyloxypropyl), 1630⁴.
- C₂₀H₂₅O₂S** Naphthalenesulfonic acid, menthyl ester, 1643⁹.
- C₂₀H₂₅O₄** Cyclohexanol, 2-cyclohexyl-, acid phthalate, 375⁶.
- C₂₀H₂₅O₁₁S** 1,5-Glucoside, 3(and 6)-*p*-toluene sulfonyltriacyetyl- β -methyl-, 64¹.
- C₂₀H₂₅S** Sulfide, bis(α -propylbenzyl), 2673⁷.
- C₂₀H₂₅BrO₂** Malonic acid, α -(bromopivalyl methyl)benzyl-, di-Et ester, 894¹.
- C₂₀H₂₅NO** 2-Hexanol, 3-amino-2-benzyl-5-methyl-1-phenyl-, 567⁸.
- C₂₀H₂₅NO₂S** 2-Naphthalenesulfonamide, *N*-menthyl-, 798^{4,6,7,8}.
- C₂₀H₂₅NO₂** Thebainonemethine, methyl-dihydro-, and -*HCl*, 247⁸.
- C₂₀H₂₅NO₄** Des-*N*-methylmethylidihydrohydroxythebainone, 2698⁸.
- C₂₀H₂₅NO₄S** *p*-Toluenesulfonamide, *N* (α acetylbenzyl)-, di-Et acetal, 75².
- C₂₀H₂₅NO₄** Porphyroxine, methohydrochloride, 589².
- C₂₀H₂₅N₂O₂** Dihydrobase from dihydrocodeinone, perchlorate, 2698¹.
- C₂₀H₂₅BrNO₂S** Allyldihydroxymethylphenylammonium bromocamphorsulfonate, 65⁵.
- C₂₀H₂₅HIO₂**, 543⁸.
- C₂₀H₂₅INO₂** Des-*N*-methylidihydrohydroxycodeinone, dihydro-, methiodide, 2698⁴. Hydrosinomenine, methiodide, 1655⁹. Thebainone, dihydrohydroxy-, Me ether, methiodide, 2698⁸.
- C₂₀H₂₅N₂O₄** 3-Pyrrolicarboxylic acid, 5,5'-sec-butylidenebis[2-methyl-, di-Et ester, 381⁶.
- C₂₀H₂₅N₂O₄** Hydrosinomenine, semicarbazone, 1655⁹.
- C₂₀H₂₅O₂** Malonic acid, α pivalylmethylbenzyl-, di-Et ester, 894¹.
- C₂₀H₂₅O₂Zr**, 543⁸.
- C₂₀H₂₅Sn** Stannic dibenzylbutylethyl-, 904⁸.
- C₂₀H₂₅ClO₂S** 3-*p*-Cymenesulfonic acid, 6-chloro-, bornyl ester, 2890⁷.
- C₂₀H₂₅NO₂** Cyclohexanol, 2-(cyclohexylmethyl)-, carbanilate, 409¹. Morphimethine, methyldeoxytetrahydro- α -methyl-, salts, 247⁸.
- C₂₀H₂₅NO₂** Thebainonemethine, dihydromethyl-dihydro-, and salts, 247⁸.
- C₂₀H₂₅NO₄** Des-*N*-methylmethylidihydrohydroxythebainone, dihydro-, Me ether, and chloroplatinate, 588⁹, 589⁴.
- C₂₀H₂₅Ag₂NO₂S₂** + H₂O Camphor, β -mercapto-, Ag deriv., AgNO₂ compd., 908¹.
- C₂₀H₂₅BrNO₂S** Hydroxymethylphenylpropylammonium bromocamphorsulfonate, 65⁵.
- C₂₀H₂₅INO₂** Methiodide of compd. from acetyl- β -methylmorphimethine, 1125¹.
- C₂₀H₂₅N₂O** Butyrophenone, α , β -di-1-piperidyl-, 2230⁸.
- C₂₀H₂₅N₂O** Porphyroxine, tetrahydro-, Me ether, oxime, 589⁴.
- C₂₀H₂₅N₂O₂** Spiro[1,3,5,2 oxadiazine - 2,1'-cyclohexane - 3',2' - 1,3,5,2 oxadiazine] - 4,5',4''(3,3') - trione, 2'-acetyl - 5,6,5'',6'' tetrahydro - 3,5,2',4'-3'',5'' - hexamethyl - 6,6'' - bis(methylimino)-, 2131³.
- C₂₀H₂₅N₂O₁₁V** Caffeidine, ganadylmalonate, 2230⁸.
- C₂₀H₂₅O₂** (See also *Abietic acid*.) Acid from whale oil, 1366². Cannabinol, 2050⁹.
- C₂₀H₂₅NO₂** Morphimethine, methylidihydrodeoxytetrahydro- γ -methyl-, and salts, 247⁸. 1-Tridecenol, carbanilate, 2873⁶.
- C₂₀H₂₅INO₂** Morphimethine, dihydrodeoxytetrahydro- α -methyl-, methiodide, 247⁸.
- C₂₀H₂₅N₂O₂** Enanthamide, *N*, *N'*-*p*-phenylenebis-, 2884⁸.
- C₂₀H₂₅N₂O₂S₂** Butylsulfuric acid, benzidine salt, 53².
- C₂₀H₂₅O₂** Acid from whale oil, 1366², 1719⁸. Etiocholanolic acid, 591⁸.
- C₂₀H₂₅O₂** 3 Dodecanone, 1-(3,4-dimethoxyphenyl)-, 3623⁸.
- C₂₀H₂₅O₂** Dicarboxylic acid from copal, 1889⁴. Dihydroxy acid from abietic acid, 298⁸. Oxidation product of rubber, 1901⁸.
- C₂₀H₂₅O₂** Dicarboxylic acid ozonide from copal, 1889⁴.
- C₂₀H₂₅O₄** Fructoside, tetracarboethoxy- γ -ethyl-, 2880².
- C₂₀H₂₅NO₂** 3-Dodecanone, 1-(3,4-dimethoxyphenyl)-, oxime, 3623⁸.
- C₂₀H₂₅N₂O₂** Etiocholanone, semicarbazone, 591⁸.
- C₂₀H₂₅N₂O₂** 3-Hendecanone, 1-(3,4-dimethoxyphenyl)-, semicarbazone, 3623⁸.
- C₂₀H₂₅** 1,19-Tricosadiene, 2117⁴.
- C₂₀H₂₅N₂O₂** 2(1)-Pyrimidone, 5,5-diallyl-4,6-epoxytetrahydro-4,6-diisomyl-(?), 3351⁹.
- C₂₀H₂₅O** Compd., b. p. 120-30°, from dehydration of homocamphenilol, 2891³.
- C₂₀H₂₅O₂** Acid from whale oil, 1366². Ester from copal, 1889⁴.
- C₂₀H₂₅O₄** Trihydroxy acid from abietic acid, 298⁸.
- C₂₀H₂₅O₁₀** See *Strophanthine*.
- C₂₀H₂₅N₂O₂** Adipic acid, α , δ -di-1-piperidyl-, di-Et ester, and di-*HCl*, 59⁸.
- C₂₀H₂₅O₂** Ac deriv. of alcohol from bark, 599⁹.
- C₂₀H₂₅O₂** Acid from sei-whale oil, 1719⁸.
- C₂₀H₂₅O₄** 1,16-Hexadecanedicarboxylic acid, mono-Et ester, 391¹. Rosilic acid, acetate, 893⁸. Thapsic acid, di-Et ester, 3182⁸.
- C₂₀H₂₅O₁₁** Turanose, octamethyl-, 392⁴.
- C₂₀H₂₅Cl₂NO** Stearamide, α , α -dichloro-*N*-ethyl-, 2875⁹.
- C₂₀H₂₅Au₂Cl₂S₂**, 3495⁹.
- C₂₀H₂₅N₂O₂** Suberic acid, α , δ -bis(diethylamino)-, di-Et ester, 60⁸.

- $C_{20}H_{40}O_2$ (See also *Arachidic acid*.)
Capric acid, decyl ester, 2658³.
Ceryl ester of acid from bark, 599².
Eicosic acid, 13¹.
Palmitic acid, Bu ester, P 593⁴.
- $C_{20}H_{40}O_4$ Choleic acid, 2283⁴.
- $C_{20}H_{41}NO$ Stearamide, *N*-ethyl-, 2875⁹.
- $C_{20}H_{41}O$ Decyl ether, 2658⁷.
- $C_{20}H_{42}CuN_4O_4P_2 + 4H_2O$ Tetraethylphosphonium cupribiuret, 866².
- $C_{20}H_{42}N_4$ Spermine, decamethyl-, salts, 1964^{3,7}.
- $C_{21}H_{21}Br_3N_3O_7$ 5-Triazine, 2,4,6-tris(3,5-dibromosalicyl)-, 921¹.
- $C_{21}H_{21}Br_2ClO_2$ 9-Phenanthrol, 2,7-dibromo-10-chloro-, benzoate, 2895².
- $C_{21}H_{21}Br_2N_3O_7$ Phenanthrine, 3-amino-6,11-dibromo-, picrate, 2895².
- $C_{21}H_{21}N_3O_5$ 5-Triazine, 2,4,6-tris(5-nitrosalicyl)-, 915¹.
- $C_{21}H_{21}O$ 13- $\alpha\alpha'$ -Dibenzofluorenone, 581⁴.
- $C_{21}H_{21}O_6$ 3-Indenecarboxylic acid, 2,2'-methylenebis(1-keto-, and *Na* salt, 3900⁴.
- $C_{21}H_{21}Br$ $\alpha\alpha'$ -Dibenzofluorene, 13-bromo-, 239², 581⁴.
- $C_{21}H_{21}Cl$ $\alpha\alpha'$ -Dibenzofluorene, 13-chloro-, 581⁴.
- $C_{21}H_{21}I$ $\alpha\alpha'$ -Dibenzofluorene, 13-iodo-, 239², 581⁴.
- $C_{21}H_{21}IN_3O_8$ 8-Quinololinol, 5-amino-7-iodo-, dipicrate, 1461⁴.
- $C_{21}H_{21}NO$ 9-Naphth-3,10-acridin-9-one, 3-methyl-, 1268¹.
- $C_{21}H_{21}NO_4$ Benzoic acid, *m*-(1-anthraquinonylamino)-, 1267².
- Fluorene, 2-nitro-9-piperonylidene, 3362³.
- $C_{21}H_{21}N_7O_7$ 2-Triazoloquinoline, 2-phenyl-, picrate, 2129⁶.
- $C_{21}H_{21}BrClN$ 9-Anthramine, 10-(bromomethylene)-1,5-dichloro-9,10-dihydro-*N*-phenyl-, 1261⁴.
- $C_{21}H_{21}Br_2O_3$ Bromocresol green, 1773³.
m-Cresolsulfonephthalein, tetrabromo-, 1111³.
- $C_{21}H_{21}Cl_2$ Anthracene, 9-benzyl-1,5-dichloro-, 1260².
—, 1,5-dichloro-9,10-dihydro-9-methylene-10-phenyl-, 3191⁵.
- $C_{21}H_{21}Cl_4O_3$ *m*-Cresolsulfonephthalein, tetrachloro-, 1111³.
- $C_{21}H_{21}N_2O_4$ Indirubinmalonic acid, Et ester, 89².
- $C_{21}H_{21}N_2O_2$ 1,4-Imidazopyridin-2(3)-one, 3,3'-benzenylbis-, 1264⁸.
- $C_{21}H_{21}N_2O_8$ 8-Quinololinol, 7-amino-, dipicrate, 1461⁴.
- $C_{21}H_{21}O$ 13- $\alpha\alpha'$ -Dibenzofluorene, 581⁴.
- $C_{21}H_{21}O_2$ Spiro[1,2-benzopyran-2,3'-4,3- β -naphthopyran], 3195².
- $C_{21}H_{21}O_2$ 5,6-Benzoflavone, 2-acetyl-, 2472³.
- $C_{21}H_{21}O_4$ 4,3- β -Naphthopyran-1- α -benzoic acid, 3-keto-, Me ester, 3616⁴.
Spiro[indan-2,1'-cyclopentane-2',2''-indan]-1,3,1'',3''-tetrone, 3203².
- $C_{21}H_{21}O_4$ Fluorescein, Me ester, and *-HCl*, 1983³.
- $C_{21}H_{21}O_4$ 7-meso-Benzanthrone, trihydroxy-, diacetate, 2894^{7,9}.
- $C_{21}H_{21}O_5$ $\Delta^4(5)\alpha$ -Furanacetic acid, 3-hydroxy-5-keto- $\alpha,4$ -bis(3,4-methylenedioxyphenyl)-, Me ester, 1110⁶.
- $C_{21}H_{21}$ Benzohydryl, α -phenylethynyl-, 1980⁹.
- $C_{21}H_{21}AgN_3$ Imidazole, 2,4,5-triphenyl-, Ag deriv., and *NH* compd., 3054².
- $C_{21}H_{21}AsO_8$ Gallic acid, arsenate, 1105².
- $C_{21}H_{21}Bi$ Bismuthine, tris(*p*-carboxyphenyl)-, 2466⁷.
- $C_{21}H_{21}BiCl_2$ Bismuthine, tris(*o*-carboxyphenyl)-, dichloride, 2466⁸.
- $C_{21}H_{21}BrO_3$ 2(1)-Benzofuranone, 1-(5-bromosalicyl)-5,6-dihydroxy-, triacetate, 1984².
- $C_{21}H_{21}ClO$ 3-Styryl- β -naphthopyrylium chloride, 1267⁴.
- $C_{21}H_{21}ClO_2$ 3-(β -Hydroxystyryl)- β -naphthopyrylium chloride, 1267⁴.
- $C_{21}H_{21}ClO_3$ 4-Benzopyranopyranone, 2-(chlorostyryl)-5-methyl-, 2258^{3,9}.
- $C_{21}H_{21}ClN$ 9-Anthracenemethylamine, 2,5-dichloro-*N*-phenyl-, 1260⁴.
- $C_{21}H_{21}CuN_2$ Imidazole, 2,4,5-triphenyl-, Cu deriv., 3054².
- $C_{21}H_{21}KN_2$ Imidazole, 2,4,5-triphenyl-, K deriv., and *NH* compd., 3054².
- $C_{21}H_{21}KO_3U$ + 9 or 13H₂O Potassium trisallylouranate, 2231³.
- $C_{21}H_{21}LiN_2$ Imidazole, 2,4,5-triphenyl-, Li deriv., and *NH* compd., 3054².
- $C_{21}H_{21}N$ 2,3- α -Naphthacridine, 6,7-dihydro-, 1123⁴.
- $C_{21}H_{21}NO$ Quinoline, 3-phenoxy-2-phenyl-, 1122².
4(1)-Quinolone, 1,2-diphenyl-, 3190².
- $C_{21}H_{21}NO_2$ Anthraquinone, 1-*m*-toluino-, 1267².
Fluorene, 9-*p*-methylbenzal-2-nitro-, 3362².
- $C_{21}H_{21}NO_3$ Fluorene, 9-anisal-2-nitro-, 3362².
—, 9-*o*-methoxybenzal-2-nitro-, 3362².
- $C_{21}H_{21}N_2Na$ Imidazole, 2,4,5-triphenyl-, Na deriv., 3054².
- $C_{21}H_{21}NO$ Phenol, *p*-(2-phenyl-3-quinolyazo)-, 2474⁵.
3-Quinololinol, 2-phenyl-4-phenylazo-, 2474⁵.
- $C_{21}H_{21}N_3O_2$ 1,3,4-Oxadiazole, 2-(benzoylimino)-2,3-dihydro-3,5-diphenyl-, 913³.
- $C_{21}H_{21}N_3O$ Quinoline, addn. compd. with C₂O₂ and PhNH₂, 735⁸.
- $C_{21}H_{21}N_3O_5$ Anthracene, addn. compd. with trinitrotoluene, 73⁴.
- $C_{21}H_{21}N_3O_2$ Phenol, 2-nitro-4,4'-azoxybis-, acetate, benzoate, 1972⁴.
- $C_{21}H_{21}N_7$ 4',5'-Di[1'-methyl-1',2',3'-triazolo]-1,2,7,8-acridine, 9-phenyl-, 2689².
- $C_{21}H_{21}N_7O_7$ Pyridine, 2,2',2''-nitrilotris-, picrate, 3620¹.
- $C_{21}H_{21}Br_2$ Indan, 1,2-dibromo-1,3-diphenyl-, 3614⁴.
Propene, 3,3-dibromo-1,1,2-triphenyl-, 3902².
- $C_{21}H_{21}Br_2O_2$ *o*-Cresolbenzein, dibromo-, and *-HBr*, 1645^{2,3}.
- $C_{21}H_{21}Br_2O_3$ Bromocresol purple, 2235⁴.
- $C_{21}H_{21}ClN_2O$ Isoindazole, 5-acetamido-1-chloro-1,3-diphenyl-, 2693³.
- $C_{21}H_{21}N_2O$ Hydrocarbostyryl, 3-phenyl-4-phenylimino-, and *-HCl*, 1986⁹, 1987³.
Indole, 3-benzamido-2-phenyl-, 913³.
- $C_{21}H_{21}N_2O_2$ α -Tolunitrile, α -(*p*-hydroxyanilino)-, benzoate, 1794².
- $C_{21}H_{21}N_2O_2$ Benzanilide, *o*-formyl-, *O*-benzoyloxime, 1119³.
Glyoxyloanilide, α -phenyl-, oxime, Bz deriv., 1099¹.
- $C_{21}H_{21}N_2O_3$ Glyoxylic acid, salicyl-, benzoyl-phenylhydrazone, 1117¹.
Phenol, *p,p'*-azobis-, acetate, benzoate, 1971⁷.
- $C_{21}H_{21}N_2O_3$ Phenol, *p,p'*-azoxybis-, acetate, benzoate, 1972^{2,3}.
- $C_{21}H_{21}N_2O_3$ *o*-Cresolbenzein, dinitro-, 1645².

- C₂₁H₁₆N₂O₈S₂** 1(2)-Benzisozulfonazocarboxylic acid, 2-*o*-tolylsulfonylimino-, phenyl ester, 2888¹.
- C₂₁H₁₅N₃S** Urea, dinaphthylthio-, 671⁷.
- C₂₁H₁₅N₃O** 1,4-Imidazopyridin-2(3)-one, 3,3'-benzalbis-, 1264⁴.
- C₂₁H₁₅N₃O₃** 1,4-Imidazopyridin-2(3)-one, 3,3'-*p*-hydroxybenzalbis-, 1265³.
- C₂₁H₁₅N₃O₄** 5-Pyrazolocarboxylic acid, 1-(4-cyano-2-nitrophenyl)-3-styryl-, ethyl ester, 2901⁸.
- C₂₁H₁₅O** Benzohydrol, α -phenylethynyl-, 1980². Phthalan, 1-benzal-2-phenyl-, 3197².
- C₂₁H₁₅O₂** 1,2-Benzopyran-4-ol, 2,2-diphenyl-, 3613⁸.
- 9-Fluoreno**l, 9-methyl-, benzoate, 3902⁷.
- C₂₁H₁₅O₂** Benzophenone, 4-hydroxy-3-methyl-, benzoate, 1645⁴.
- 9-Xanthencarboxylic acid**, benzyl-, 3904⁸.
- C₂₁H₁₅O₂** Cresolphthalein, 1773³.
- C₂₁H₁₅O₂S** 1,4-Thiopyrone, tetrahydroadiperynylidene-, 1262².
- C₂₁H₁₅O₃** Coumarin, 5,7-dihydroxy-3-(*p*-hydroxyphenyl)-, triacetate, 3193⁸.
- C₂₁H₁₅Br** Propene, 3-bromo-1,1,2-triphenyl-, 3902⁸.
- C₂₁H₁₅BrClNO** Benzamide, *N*-(*p*-bromobenzyl)-*N*-(*p*-chlorobenzyl)-, 53⁹.
- C₂₁H₁₅BrINO** Benzamide, *N*-(*p*-bromobenzyl)-*N*-(*p*-iodobenzyl)-, 54¹.
- C₂₁H₁₅Br₂N₂** Benzaldehyde, *o*-bromo-, bis(*o*-bromobenzyl)hydrazone, 2686¹.
- C₂₁H₁₅Br₂N₂O₂** 1-(2,3,6-Tribromo-4,5-dihydroxyphenyl)pyridinium bromide, dipyridine salt, 1640².
- C₂₁H₁₅Cl₂NO** Benzamide, *N*, *N*-bis(chlorobenzyl)-, 53⁹, 54^{1,2}.
- C₂₁H₁₅NO₂** Benzamide, *N*-(*p*-acetylphenyl)-*N*-phenyl-, 3190⁴.
- Benzimidic acid**, *N*-phenyl-, *o*(and *p*)-acetylphenyl ester, 3190².
- 4-Naphth-1,8- α β -acridine-8-carboxylic acid**, 5,6,6a,7-tetrahydro-, 1123³.
- C₂₁H₁₅NO₂** Ketone, β -aminopropenyl 2-hydroxy-1-naphthyl, benzoate, 2472².
- C₂₁H₁₅NO₂S** Quinaldine, 8-methoxy-3-(2-naphthylsulfonyl)-, and salts, 411^{4,6}.
- C₂₁H₁₅N₃** Benzimidazole, 5-benzalamino-1-*p*-tolyl-, 2691³.
- Guanidine**, dinaphthyl-, 672^{3,4}.
- C₂₁H₁₅N₃O** Anthranilaldehyde, *N*-[*o*-(*o*-aminobenzalamino)benzal]-, and *ds*-HCl, 761³.
- 9-Fluorenone**, 2-(*p*-dimethylaminophenylazo)-, 1644².
- Isoindazole**, 5-acetamido-1,3-diphenyl-, 2693⁶.
- 6-Phenhomazine**, *N'*-anthranilaldehyde, 5,6-dihydro-, 1641³.
- C₂₁H₁₅N₃O₂** Acridine, 5-(*p*-dimethylaminophenyl)-3-nitro-, 2903⁸.
- C₂₁H₁₅N₃S** 1,4,3-Isotriadiazine, 2,3-dihydro-3,5-diphenyl-2-phenylimino-, 3200⁸.
- C₂₁H₁₅N₃NaO₄** 5-Pyrazolone, 4,4'-methenylbis[3-methyl-1-phenyl]-, Na deriv., 3362⁹.
- C₂₁H₁₅BiCl₂N₂O₄** Bismuthine, tris(3-nitro-*o*-tolyl)-, dichloride, 2460⁸.
- C₂₁H₁₅BrClNO₂** Dibenzylamine, *p*-bromo-*p'*-chloro-*N*-methyl-, picrate, 53⁹.
- C₂₁H₁₅Br₂N₂** Benzaldehyde, bis(*o*-bromobenzyl)hydrazone, 2685⁹.
- C₂₁H₁₅Br₂O₂** *o*-Cresolbenzein, dibromo-, hydrate, 1645⁴.
- C₂₁H₁₅Br₂O** 2(1)-Benzofuranone, 1-bromo-1-(α -bromoveratryl)-5,6-dihydroxy-, diacetate, 1984⁸.
- C₂₁H₁₅ClNO** Benzamide, *N*-benzyl-*N*-(*p*-chlorobenzyl)-, 53⁹.
- C₂₁H₁₅INO₃S** 1-Methyl-3-(2-naphthylsulfonyl)-quinaldinium iodide, 411⁶.
- C₂₁H₁₅N₂** Hydrobenzamide, 2257⁷.
- C₂₁H₁₅N₂O** Diimide, α -acetyl- β -triphenylmethyl-, 1455⁹.
- C₂₁H₁₅N₂O₂** *o*-Phenylenediamine, *N*¹(and *N*²)-acetyl-*N*¹(and *N*¹)-benzoyl-4-phenyl-, 2378³.
- Pyridine**, 1,2-dihydro-1-phenacyl-2-phenacylimino-, and chloroplatinates, 246⁹.
- C₂₁H₁₅N₂O₂** Methane, (2,4-dinitrophenyl)di-*p*-tolyl-, 3905².
- Phthalimide**, *N*-[β -(2-acetyl-6-methoxy-3-indyl)ethyl]-, 1270¹.
- C₂₁H₁₅N₂O₂S** Benzisozulfonazole, 1-benzyl-1,2-dihydro-2-tolylsulfonylimino-, 2888¹.
- C₂₁H₁₅N₂O₂** 5-Pyrazolone, 4,4'-methenylbis[3-methyl-1-phenyl]-, 3362⁹.
- C₂₁H₁₅N₂O₃** Benzoic acid, 3-glyoxyl-4-hydroxy-, ozonate, 1980⁸.
- Compd.**, m. 248⁹, **Com** 3, β -benzalbis-1,4-imidazopyridin-2(3)-one, 1265².
- C₂₁H₁₅N₂O₄** 5-Pyrazolocarboxylic acid, 1-(4-cyano-2-nitrophenyl)-3-phenethyl-, ethyl ester, 2901⁸.
- C₂₁H₁₅N₂O₄** Tribenzylamine, *m*, *m'*, *m''*-trinitro-, 73⁸.
- C₂₁H₁₅N₂S** 1,3,4-Triazole, 2-anilino-5-(benzylmercapto)-1-phenyl-, 2900⁸.
- C₂₁H₁₅N₂O₄** Acrylophenone, β -(α or β)-(3-nitrophenyl)hydrazinol-, *p*-nitrophenylhydrazone, 1450⁴.
- C₂₁H₁₅N₂O₄** Pyridine, 3-(2-pyrrolidyl)-, dipicrate, 3905².
- C₂₁H₁₅O** 2-Propanone, 1-triphenyl-, 1455⁹.
- C₂₁H₁₅O₂** Acetic acid, diphenyl, *p*-tolyl ester, 1117⁷.
- Benzoin**, α -benzyl-, 379⁹.
- o*-Cresolbenzein**, 2266⁹, and salts, 1645^{1,2}.
- C₂₁H₁₅O₂** *o*-Toluic acid, α , α -bis(4-hydroxyphenyl)-, Me ester, 404².
- C₂₁H₁₅O₂S** Cresol red, 1773³.
- m*-Cresolsulfonephthalein**, 1111².
- C₂₁H₁₅O₃** *p*-Coumaric acid, *p*-coumarate, acetate, Me ester, 1257⁸.
- C₂₁H₁₅O₇** Δ^2 (δ)- α -Furanacetic acid, α ,4-di-*o*-anisyl-3-hydroxy-5-keto-, Me ester, 1110⁴.
- Isoflavone**, 5,7-dihydroxy-4'-methoxy-2-methyl-, diacetate, 246⁹.
- C₂₁H₁₅O₄** 2(1)-Benzofuranone, 5,6-dihydroxy-1-veratral-, diacetate, 1984⁸.
- , 1-(3,5-dimethoxybenzal)-5,6-dihydroxy-, diacetate, 1984⁸.
- C₂₁H₁₅O₄** Phloracetophenone, α -hydroxy-, benzoate, triacetate, 93⁹.
- C₂₁H₁₅Br₂N₂** Hydrazine, tris(*o*-bromobenzyl)-, -HCl, 2685⁹.
- C₂₁H₁₅ClO₁₀** 2-(3,5-Dimethoxybenzal)-3,6,7-trihydroxy-2-benzofurorium perchlorate, 6,7-diacetate, 1984⁸.
- C₂₁H₁₅NO** Benzaldehyde, *p*-dibenzylamino-, 1452⁹.
- 7,8-Benzquinoline**, 1-benzoyl-1,2,3,4-tetrahydro-2-methyl-, 96⁷.
- Ethanol**, 2-benzalamino-1,2-diphenyl-, 2254⁸.
- Propionamide**, β -triphenyl-, 2670⁹.
- C₂₁H₁₅NO₂** 2(1)-Benzofuranone, 1,3,5-trimethyl-1-(1-naphthylamino)-, 911⁷.
- o*-Benzotoluide**, 5'-*p*-toloxy-, 2685¹.
- Hydroxylamine**, β , β -dibenzyl-, benzoate, 1638⁸.

- Propionohydroxamic acid, β -triphenyl-, 2671¹.
- $C_{21}H_{21}NO_3$ 3-Pyranquinolone, 7-benzoyl-7,8,9,10-tetrahydro-8,10-dimethyl-, 411¹.
- $C_{21}H_{21}NO_4U$ Ammonium tribenzoatouranate, 2231¹.
- $C_{21}H_{21}NO_{11}U$ Ammonium tri- p -hydroxy-benzoatouranate, 2231¹.
- Ammonium trisalicatouranate, 2231¹.
- $C_{21}H_{21}NS$ Benzamide, thio- N , N -di- p -tolyl-, 77¹.
- Benzimidic acid, thio- N - p -tolyl-, p -tolyl ester, 77¹.
- $C_{21}H_{21}N_2$ Aniline, p -(2-fluorylazo)- N , N -dimethyl-, 1644¹.
- $C_{21}H_{21}N_2O$ Benzamide, N -phenacyl-, phenylhydrazone, 913¹.
- $C_{21}H_{21}N_2O_2$ Hydrocinnamanilide, α -amino-, picrate, 3355¹.
- $C_{21}H_{20}$ Bibenzyl, p -benzyl-, 82¹, 1803¹.
- Propane, 1,2,3-triphenyl-, 82¹, 1803¹.
- $C_{21}H_{21}N$ Benzylamine, N -diphenylmethylenemethiodide, 3901¹.
- $C_{21}H_{21}N_2O$ Aceto acid, triphenylmethylhydrazide, 1455¹.
- Urea, α -(β , β -diphenylethyl)- β -phenyl-, 52¹.
- $C_{21}H_{21}N_2O_2$ 2,7-Fluorendiamine, N , N , N' , N' -tetraacetyl-, 238¹.
- $C_{21}H_{21}N_2O$ Acetophenone, 4-diphenylaminosemicarbazone, 691¹.
- $C_{21}H_{21}N_2O_2$ Benzylethylhydroxyphenylammonium picrate, 65¹.
- Benzylhydroxymethyl- p -tolylammonium picrate, 66¹.
- $C_{21}H_{21}O_2$ o -Gresol, 4,4'-benzalbis-, 1645².
- 1,2-Propanediol, 1,1,3-triphenyl-, 3360¹.
- $C_{21}H_{21}O_2$ Flavone, 7-hydroxy-3,5,3',4'-tetramethoxy-, acetate, 1267¹.
- $C_{21}H_{21}O_{11}$ See *Isoquercitrin*; *Quercitrin*.
- $C_{21}H_{21}O_{12}$ Quercimeritrin, 1267¹.
- $C_{21}H_{21}AsS$ Arsine, tri- p -tolyl-, sulfide, $HgCl_2$ compd., 905¹.
- $C_{21}H_{21}Bi$ Bismuthine, tri- o -tolyl-, 2466¹.
- $C_{21}H_{21}BiCl_2$ Bismuthine, tri- o -tolyl-, dichloride, 2466¹.
- $C_{21}H_{21}BiCl_3O_2$ Bismuthine, tri- p -anisyl-, dichloride, 2466¹.
- $C_{21}H_{21}BiN_2O_2$ Bismuthine, tri- o -tolyl-, dinitrate, 2466¹.
- $C_{21}H_{21}BiO_2$ Bismuthine, trianisyl-, 2466¹.
- $C_{21}H_{21}BiO_7S_2$ Bismuthine, (4-sulfo- o -tolyl)-di- o -tolyl-, sulfate, 2466¹.
- $C_{21}H_{21}BiO_{10}S_2$ Bismuthine, bis(4-sulfo- o -tolyl)- o -tolyl-, sulfate, 2466¹.
- $C_{21}H_{21}Br_2NO$ Pseudocumol, 3,6-dibromo- α -(4-dimethylamino-1-naphthyl)-, 903¹.
- $C_{21}H_{21}ClO_2$ 3- β -Glucosidoxyl-7-hydroxyflavylium chloride, 1268¹.
- $C_{21}H_{21}N$ Tribenzylamine, 73¹.
- $C_{21}H_{21}NO_2S$ Toluenesulfonamide, N -(β -hydroxy β , β -diphenylethyl)-, 568¹.
- $C_{21}H_{21}NO_2$ Palmatine, 1988¹.
- Papaverine, methylene-, 1125¹.
- $C_{21}H_{21}NO_4S_2$ Di- α -toluenesulfonyl- p -toluide, 99¹.
- $C_{21}H_{21}NO_2S$ Oxypalmatine, 1988¹.
- $C_{21}H_{21}NO_2$ Propionic acid, β -benzoyl- β -hydroxy- α -phenyl-, Me ester, oxime, dibenzoate, 583¹.
- $C_{21}H_{21}N_2O_2$ Alanine, β -phenyl-, addn. compd. with p -phenylazophenol, 68¹.
- $C_{21}H_{21}N_2O_4$ Phthalimide, N -(δ , ϵ -diketohexyl)-, 4-(m -anisyl)hydrazonate, 1270¹.
- $C_{21}H_{21}O_4P$ o -Tolyl phosphate, 55¹.
- $C_{21}H_{21}Br_2O_3$ 3-Pentanone, 1,2,4,5-tetrabromo-1,5-bis(3,4-dimethoxyphenyl)-, 3611¹.
- $C_{21}H_{21}P$ Dibenzylmethylphenylphosphonium iodide, 664¹.
- $C_{21}H_{21}NO_2P$ Dibenzylmethylphenylphosphonium nitrate, 664¹.
- $C_{21}H_{21}N_2O_2$ (See also *Strychnine*.)
- 1,2-Benzacridine, 8-acetamid-10-12-acetylhexahydro-(?), 1122¹.
- Normethylstrychnine, 3364¹.
- $C_{21}H_{21}N_2O_2$ Strychnine, N -oxide, and -III-, 384¹.
- $C_{21}H_{21}N_2O_2$ Alanine, N -(α -benzamidocinnamyl)-, Et ester, 1813¹.
- $C_{21}H_{21}N_2O_2S$ Strychnine, N -sulfonated ether, 384¹.
- $C_{21}H_{21}N_2O_2S_2$ m -Benzenedisulfonyl- p -toluide, 2-hydroxy-5-methyl-, 3897¹.
- $C_{21}H_{21}N_2O_7$ Ketone, 3,4 (and 4,5)-dimethoxy-2-nitrophenyl 1,2,3,4-tetrahydro-2,3-dimethyl-6,7-methylenedioxy-1-isoquinolyl-, 1990¹.
- $C_{21}H_{21}O$ Carbonic acid, bis(5,6,7,8-tetrahydro-2-naphthyl) ester, 1983¹.
- $C_{21}H_{21}O_{12}$ See *Isoquercitrin*; *Quercitrin*.
- $C_{21}H_{21}NO_2$ (See also α -Lobeline.)
- Chalcone, p -methoxy- α -1-piperidyl-, 3905¹.
- $C_{21}H_{21}NO_2$ Cinnamic acid, ethoxybenzalaminomethyl, Et ester, 2597¹.
- $C_{21}H_{21}NO_2$ Papaverine, dihydromethylene-, 1125¹.
- $C_{21}H_{21}NO_2$ (See also *Heroine*.)
- Morphine, diacetyl-, 2061¹.
- $C_{21}H_{21}N_2O_2$ Phthalamic acid, N -(δ , ϵ -diketohexyl)-, δ -(m -anisyl)hydrazonate, 1270¹.
- $C_{21}H_{21}N_2O_7$ Isopyrrole, 3,4,5-trimethyl-2-(3,4,5-trimethyl-2-pyrrylmethylene)-, picrate, 85¹.
- $C_{21}H_{21}GeSn$ Germane, triphenyl(trimethylstannyl)-, 904¹.
- $C_{21}H_{21}N_2$ Cinnamaldehyde, cyclohexylphenylhydrazonate, 1102¹.
- $C_{21}H_{21}N_2O$ Strychnidine, and -III-, 3365¹.
- $C_{21}H_{21}N_2O_2$ Pyrazoledione, dibenzylidethyl-, 1329¹.
- $C_{21}H_{21}N_2Q_2$ Allostrychnidone, 3366¹.
- Strychnidone, 3366¹.
- $C_{21}H_{21}N_2O_2$ Propionamide, N , N' -bis(p -carboxyphenyl)-, di-Et ester, and -HCl, 236¹.
- $C_{21}H_{21}N_2O_2S$ Naphthionic acid, N -acetyl-, pseudocumidine salt, 3361¹.
- $C_{21}H_{21}N_2O_2$ Hydrohydrastinine, 3-methyl-1-(6-nitroveratryl)-, 1990¹.
- $C_{21}H_{21}N_2O_7$ Quinoline, 2-cyclohexyl-1,2,3,4-tetrahydro-, picrate, 914¹.
- $C_{21}H_{21}NO_2$ Morphopiperidine, N - p -methylbenzyl-, picrate, 413¹.
- $C_{21}H_{21}NO_{10}$ 1-Propanol, 1-(3,4-methylenedioxyphenyl)-2-(1-piperidyl)-, picrate, 2271¹.
- $C_{21}H_{21}O_2$ 1,3,6-Naphthalenetetracarboxylic acid, 4,7-dimethyl-, tri-Et ester, 1647¹.
- $C_{21}H_{21}O_{10} + 2H_2O$ See *Phlorhizin*.
- $C_{21}H_{21}O_{11}$ Benzaldehyde, 4- O -tetraacetylglucosidoxyl-2-hydroxy-, 1268¹.
- $C_{21}H_{21}NO_4$ Corybulbine, 1125¹, 2003¹.
- Isocorybulbine, 1125¹, 1963¹.
- Palmatine, tetrahydro-, 1988¹.
- $C_{21}H_{21}NO_2$ Porphyroxine, acetate, and salts, 584¹, 5.
- $C_{21}H_{21}NO_7$ Homophthal-1-amic acid, N -(3,4-dimethoxyphenethyl)-2,3-dimethoxy-, 1989¹.

- C₂₁H₂₅N₃O Acetaldehyde, cyclohexyldiphenyl-, semicarbazone, 571⁴.
 Acetophenone, hexahydro- α , α -diphenyl-, semicarbazone, 571⁴.
 C₂₁H₂₅N₃O₂ Quinine cyanide, *py*- α -hydroxy-, *di-H Br*, 3055⁴.
 Strychnidone, oxime, 3366³.
 C₂₁H₂₅N₃O₄ Ornithine, *N*-(β -phenyl-*N*-salicylalanyl)-, 2877².
 C₂₁H₂₅N₃ Isoindoline, 2-[o-(1-piperidylmethyl)-benzyl]-, 409⁹.
 Isoquinoline, 2,2'-trimethylenebis[1,2,3,4-tetrahydro-, and salts, 1653².
 C₂₁H₂₅N₃O Benzamide, *N*-[δ -(1,2,3,4-tetrahydro-2-naphthylamino)butyl]-, 566⁴.
 C₂₁H₂₅N₃O₂ Strychnine, tetrahydro-, 3365⁷.
 C₂₁H₂₅N₃O₂ (See also *Quebrachine*; *Yohimbine*.)
 Benzoic acid, *p*-(α -*p*-phenetyliminobutylamino)-, Et ester, 236⁴.
 Isoyohimbine, and -HCl, 413⁹, 414².
 Pseudoyohimbine, and -HCl, 588¹.
 C₂₁H₂₅N₃O₂ Anhydrostrychnidonic acid, methoxymethyl-, 3266⁴.
 Morphimethine, acetyltetrahydrocyanonormethyl-, 1124⁴.
 C₂₁H₂₅N₄O₂ Amylamine, *N*-[γ -(3,4-methylene-dioxiphenyl)propyl]-, picrate, 2882².
 Valeric acid, α -dimethylamino- δ -phenyl-, Et ester, picrate, 59².
 C₂₁H₂₅N₃O₁₀ Arginine, *N*-(β -phenylalanyl), picrate, 2877².
 C₂₁H₂₅O₁₂S *d*-Glucose, tetraacetylitoluenesulfo-, 1101⁷.
 C₂₁H₂₅N₂O₂ 1-Naphthalenecarbanic acid, menthyl ester, 400⁹.
 C₂₁H₂₅NO₆ Homoveratramide, *N*-(β ,3,4-trimethoxyphenethyl)-, 1462¹, 1655².
 C₂₁H₂₅N₃ Benzaldehyde, *p* dimethylamino, cyclohexylphenylhydrazone, 1102².
 C₂₁H₂₅N₃O₂ 2-Piperidone, 3-[(*N*-acetyl- β -phenylalanyl)amino] - 1 - (*N*, *N'* - diacetyl-guanyl)-, 2877².
 C₂₁H₂₅N₄O₂ 1,5 Pentanediamine, *N*-(1,2,3,4-tetrahydro-2-naphthyl)-, picrate, 560⁴.
 C₂₁H₂₅N₃O₂ (See also *Optochine*.)
 Isovaleramidine, *N*, *N'*-di-*p*-phenetyl-, 236⁴.
 C₂₁H₂₅N₃O₂ Strychnidonic acid, methoxymethyl-, 3366⁴.
 C₂₁H₂₅N₄O₄ Porphyrone, Me ether, semicarbazone, 589⁴.
 C₂₁H₂₅N₄O₄ α -Glucoseptose, methylphenylsazone, 2879⁴; tolylosazone, 2879¹, 4.
 C₂₁H₂₅O₂ Formaldehyde, dithymyl acetal, 730⁴.
 C₂₁H₂₅IN₂O₂ Yohimbyl alcohol, methiodide, 3906².
 C₂₁H₂₅NO₂ Dipropylamine, γ , γ' -dimethoxy-*N*-methyl- γ , γ' -diphenyl-, and -HCl, 1804¹.
 1-Naphthalenecarbanic acid, decyl ester, 2659⁹.
 C₂₁H₂₅NO₄ Morphimethine, acetyltetrahydro- γ -methyl-, 1125¹.
 C₂₁H₂₅NO₃S Benzenesulfonamide, ngaiyl-, 2364².
 C₂₁H₂₅NO₃S Porphyrone, methosulfate, 589¹.
 C₂₁H₂₅N₃O₇ Alanine, *N*-cyclohexyl-, ethyl ester, picrolonate, 2876⁴.
 C₂₁H₂₅BI₂N₃ *p*-Toluidinium hexaiodobismuthite, 2855⁴.
 C₂₁H₂₅BrNO₃S Allylethylhydroxyphenylammonium bromocamphorsulfonate, 65⁴.
 C₂₁H₂₅INO₄ Des - *N* - methylmethyldihydroxythebaineone, methiodide, 2698².
 C₂₁H₂₅IN₂O₂ Methiodide of base from dihydro-codoneone, 2698¹.
- C₂₁H₂₅N₃O Benzohydrol, α -*tert*-butyl-*p*,*p'*-bis-(dimethylamino)-, 1110⁷.
 Urea, α -decyl- β -1-naphthyl-, 2658⁴.
 C₂₁H₂₅NO₈ Aniline, *p*,*p'*-[ethoxy(ethylmercapto)methylene]bis[*N*, *N* - dimethyl-, 403⁴.
 C₂₁H₂₅N₃O₂ Benzophenone, *p*,*p'*-bis(dimethylamino)-, di-Et acetal, 403⁴.
 C₂₁H₂₅N₃S₂ Benzophenone, *p*,*p'*-bis(dimethylamino)-, di-Et mercaptale, 403⁴.
 C₂₁H₂₅N₄O₂ Thebaineone methine, methyldihydro-, semicarbazone, 247⁴.
 C₂₁H₂₅N₄S Carbanilide, *p*,*p'*-bis(diethylamino)-thio-, 671⁴.
 C₂₁H₂₅O₂ Cannabinol, 3703⁴.
 C₂₁H₂₅O₂ Lupulic acid, 393⁴.
 C₂₁H₂₅NO₂ Cinnamic acid, *p* dimethylamino-, menthyl ester, 907⁹.
 C₂₁H₂₅N₄O₂ Benzene, 2,4 dinitro-1,3, β -tri-1-piperidyl-, 2681⁴.
 C₂₁H₂₅BrNO₃S Ethylhydroxyphenylpropylammonium bromocamphorsulfonate, 65⁴.
 C₂₁H₂₅INO₄ Des-*N*-methylmethyldihydroxythebaineone, dihydro-, methiodide, 2698².
 C₂₁H₂₅NO₄ Thebainemethine, dihydromethyl-dihydro-, semicarbazone, 247⁴.
 C₂₁H₂₅N₄O₄ Porphyrone, tetrahydro-, Me ether, semicarbazone, 589⁴.
 C₂₁H₂₅O₂ Myristic acid, salicylate, 1328⁴.
 C₂₁H₂₅NO₄ 1-Tridecenol, 2-methyl-, carbanilate, 2873⁴, 4.
 C₂₁H₂₅O₂ Ketone, ctiocholy methyl-, 589⁴.
 C₂₁H₂₅O₂ Etiocholanolic acid, Me ester, 591⁴.
 C₂₁H₂₅O₄ Dihydroxy acid from abietic acid, Me ester, 298⁴.
 C₂₁H₂₅N₃O₂ Isopulegone, 4-bornysemicarbazone, 3613².
 C₂₁H₂₅IN₂ Benzene, 1-(β 1-piperidylethyl)-2-(1-piperidylethyl)-, dimethiodide, 410¹.
 C₂₁H₂₅O₂ Chaulmoogric acid, allyl ester, 572⁴.
 C₂₁H₂₅O₄ Trihydroxy acid from abietic acid, Me ester, 298⁴.
 C₂₁H₂₅N₄O₇ Leucine, carbonylbis[glycyl-, diethyl ester, 3206².
 C₂₁H₂₅O₂ Stearic acid, β , γ -epoxypropyl ester, 2461³.
 C₂₁H₂₅O₄ Thiapsic acid, methyl-, di-Et ester, 3350⁴.
 C₂₁H₂₅O₂ Lactobionic acid, octamethyl-, Me ester, 1969⁴.
 Multobionic acid, octamethyl-, Me ester, 1101⁴.
 C₂₁H₂₅N₃O₂ α -Ovotyrin, 2476².
 C₂₁H₂₅N₂O₄ 5,7,12,14-Dibenzanthracenetetrone, dinitro-, 1458⁴.
 C₂₁H₂₅NO₄ 5,7,12,14-Dibenzanthracenetetrone, nitro-, 1458⁴.
 C₂₁H₂₅N₂O₂ 2-Antraquinonecarboxylic acid, 3-benzoyl-, di-nitro deriv, 1458⁴.
 C₂₁H₂₅O₄ 5,7,12,14-Dibenzanthracenetetrone, 1457⁹.
 C₂₁H₂₅NO₄ 8,12-trimeso-Benzonaphthacridine-8,12-dione, 3-methyl-, 1268².
 C₂₁H₂₅Br₂N₄O Phenanthiazine, 3-benzamido-6,11-dibromo-, 2895⁴.
 C₂₁H₂₅N₃O₄ 5,7,12,14-Dibenzanthracenetetrone, diamino-, 1458⁴.
 C₂₁H₂₅O₂ 2-Antraquinonecarboxylic acid, 3-benzoyl-, 1458⁴.
 C₂₁H₂₅Br₂N₄O₂ {1,4-Imidazopyridine[3,2']indole- Δ^1 , Δ^1 -(Δ^1 , Δ^1)} - imidazopyridine} - 2(3),-2(dione, 5',7'-dibromo-2'-hydroxy-, 1265⁴.

- C₂₂H₁₆N₂O₄ 10(12)-*α*-Benzophenazinone, 9-hydroxy-5-nitro-12-phenyl-, 1988⁴.
- C₂₂H₁₄αα'-Dibenzanthracene, P 2478⁴.
- C₂₂H₁₄BeOCl₂N₂ Addn. compd. from *α*-naphtho-nitrile and BeCl₂, 1601⁴.
- C₂₂H₁₄BrClO Furan, 3-bromo-2-(*p*-chlorophenyl)-4,5-diphenyl-, 3048².
- C₂₂H₁₄BrN₂O₂ [1,4-Imidazopyridine[3,2']indole- $\Delta^{2,3''}$ (*x',x''*)]1,4-imidazopyridine]-2-(3),2''-dione, 5'-bromo-2'-hydroxy-, 1265⁴.
- C₂₂H₁₄Br₂O Furan, 3-bromo-2-(*p*-bromophenyl)-4,5-diphenyl-, 3048².
- C₂₂H₁₄Br₃N₂O₂S 1-(2,3,6-Tribromo-4,5-dihydroxyphenyl)pyridinium sulfate, 1640².
- C₂₂H₁₄N₂ Anthracene, 9,10 dihydro-9,10-bis-(2-isopropylidene)-, 242⁴.
- 3,4-γ-Dicarbazole, 1651².
- C₂₂H₁₄N₂O₂ 5-Isodibenzophenoxazine, 5-(acetyl-imino)-, 210⁴, 241².
- C₂₂H₁₄N₂O₂ 2-Antraquinonecarboxylic acid, 3-benzoyl-, diamino deriv., 1458⁴.
- C₂₂H₁₄N₂O₂ Papaveraldoline, picrate, 1989⁴.
- C₂₂H₁₄O₂ 1-Naphthopyrone, 3-(1-naphthyl)-, 3197².
- C₂₂H₁₄O₂S [Acenaphthene[7,1'(2')thionaphthene]-8,2'-dione, 1⁴(or 2,6)-dimethyl-, 1645⁴.
- C₂₂H₁₄O₂ 13-*α*-*meso*-Dibenzoxanthelol, acetate, 406⁴.
- 1-Naphthoic acid, 8-(1-naphthyl)-, 3197².
- C₂₂H₁₄O₂ 5,7,12,14-Dibenzanthracenetetrol, 1458⁴.
- 1,4-Naphthoquinone, 2-(4-hydroxy 1 naphthyl)-, acetate, 2887⁷.
- C₂₂H₁₄BrN₂O₂ Resorcinol, [(bromophenylazo)-1-naphthylazo]-, 380⁴, 1114².
- C₂₂H₁₄BrN₂O₂ Papaveroline, bromo-, picrate, 1989⁴.
- C₂₂H₁₄BrN₂O₂ 1-Naphthylamine, 4-(*o*-bromophenylazo)-, picrate, 1114².
- C₂₂H₁₄BrO Furan, 3-bromo-2,4,5-triphenyl-, 3048².
- C₂₂H₁₄BrO₂ Δ²-1,4-Butenedione, 1-(*p*-bromophenyl)-3,4-diphenyl-, 3048².
- C₂₂H₁₄BrO₂ 4,3-β-Naphthopyran-1-*o* benzoic acid, 2 bromo-3-keto-, Et ester, 3616⁴.
- C₂₂H₁₄ClN₂O₂ Resorcinol, [(chlorophenylazo)-1-naphthylazo]-, 380⁴, 1114².
- C₂₂H₁₄ClN₂O₂ 1-Naphthylamine, 4-(*o*-chlorophenylazo)-, picrate, 1113².
- C₂₂H₁₄ClO₂ Δ²-1,4-Butenedione, 1-(*p*-chlorophenyl)-3,4-diphenyl-, 3048².
- C₂₂H₁₄ClO₂ 3-(3,4-Methylenedioxy-tyrilyl)-β-naphthopyrylium chloride, 1267².
- C₂₂H₁₄Cl₂NO₂ 9-Anthracenecarbinol, 1,5-dichloro-, carbanilate, 1260⁴.
- C₂₂H₁₄K₂O₂ Scoparin, hepta-K deriv., 575⁴.
- C₂₂H₁₄NO 9-Naphth-3,1-*β*-acridin-9-one, 1,3-(and 1,4)-dimethyl-, 1268².
- C₂₂H₁₄NO₂ Fluorene, 9-cinnamal-2-nitro-, 3362².
- 2,3-*α*-Naphthacridine-5-carboxylic acid, 6,7-dihydro-, 1123⁴.
- C₂₂H₁₄NO₂ Cinchopen, 3-phenoxy-, 1122⁴.
- 2,4-Quinolinediol, 3-phenyl-, monobenzoate, 1987².
- C₂₂H₁₄N₂ γ-Benzocarbazole, 6-phenylazo-, 1651⁴.
- C₂₂H₁₄N₂O₂ [1,4-Imidazopyridine[3,2']indole- $\Delta^{2,3''}$ (*x',x''*)]1,4-imidazopyridine]-2-(3),2''-dione, 2'-hydroxy-, 1265⁴.
- 1,4-Imidazopyridin-2(3)-one, 3,3'-(2-keto-3(2)-indylidene)bis-, 1265⁴.
- C₂₂H₁₄Cl₂ Anthracene, 1,5-dichloro-9-ethylidene-9,10-dihydro-10-phenyl-, 3191⁴.
- C₂₂H₁₄Cl₂N₂O₂ Glyoxal, (3,5-dinitro-*o*-phenyl)-, 3,5-dichlorophenylsazone, 3906⁴.
- C₂₂H₁₄N₂O₂ Coumarin, 3-benzoyl-, phenyl-hydrazone, 3787².
- C₂₂H₁₄N₂O₂ Benzanilide, *N*-(cyanomethyl)-*p*'-hydroxy-, benzoate, 1794⁴.
- Phthalimide, *N*-[*p*-(*p*-acetamidophenyl)-phenyl]-, 2891⁴.
- C₂₂H₁₄N₂O₂ Carbamohydroxamic acid, (*α* hydroxybenzyl)-, dibenzoate, 239⁴.
- C₂₂H₁₄N₂O₂ Acenaphthopyridine, 9-methyl-, picrate, 910⁴.
- Quinoline, methyl-2 phenyl-, picrate, 2695⁴, 3622².
- , 2-*p*-tolyl-, picrate, 2697⁴.
- C₂₂H₁₄N₂O₂ Quinoline, 2-*p*-anisyl-, picrate, 3622².
- C₂₂H₁₄N₂O₂ 1,2,5-Triazole-3,4-dicarboxanilide, 1-(*p*-nitrophenyl)-, 2690⁴.
- C₂₂H₁₄Na₂O₂ Scoparin, hexa Na deriv., 575⁴.
- C₂₂H₁₄O Indone, 2-phenyl-3-*p* tolyl-, 3197².
- C₂₂H₁₄O₂ 1-Naphthoic acid, 8-(1-naphthyl-methyl)-, 3197².
- Spiro[1,2-benzopyrannaphthopyran], methyl-, 3195⁴; and perchlorate, 408⁴.
- C₂₂H₁₄O₂ 4,3-β-Naphthopyran-1-*o*-benzoic acid, 3-keto-, Et ester, 3616⁴.
- C₂₂H₁₄O₂ 1,4-Naphthoquinone, 2-(3,4,5-tri-hydroxyphenyl)-, triacetate, 2887⁷.
- C₂₂H₁₄O₂ Rufopin, tetraacetate, 910⁴.
- C₂₂H₁₄ClN₂ *m*-Phenylenediamine, [(*o* chloro phenylazo)-1-naphthylazo]-, 1113².
- C₂₂H₁₄ClO₂ 3-(*p*-Methoxystyryl)-β-naphthopyrylium chloride, 1267².
- C₂₂H₁₄ClO₂ 3-(4-11hydroxy-3-methoxy-tyrilyl)-β-naphthopyrylium chloride, 1267².
- C₂₂H₁₄N 2,3-β Naphthocarbazole, 5 ethyl-, P 3058⁴.
- C₂₂H₁₄NO₂ Anthraquinone, 1-[2,5(and 3,5)-dimethylanilino], 1267².
- C₂₂H₁₄NO₂ Fluorene, 9-*o*(and *p*)-ethoxybenzal-2-nitro-, 3362².
- C₂₂H₁₄NO₂ Fluorene, 2-nitro-9-veratral-, 3362².
- C₂₂H₁₄NO₂S 2-Benzisulfonazolol, 1-benzoyl-1,2-dihydro 2-methyl-, benzoate, 3202⁴.
- C₂₂H₁₄N₂O₂ 2-Pyrrolidone, 1,5-diphenyl-3 phenyl-imidazole, nitro derivs., 2903⁴.
- , 3-(*p*-nitrophenylimino)-1,5-diphenyl-, 2903⁴.
- C₂₂H₁₄N₂O₂ 1,2,5-Triazole-3,4-dicarboxanilide, 1-phenyl-, 2690⁴.
- C₂₂H₁₄N₂O₂ Quinoline, 3-amino-2-*p* anisyl-, picrate, 2474¹.
- C₂₂H₁₄ Anthracene, 9-ethyl-10-phenyl-, 3191⁴.
- Indene, 2-benzyl-3 phenyl-, 567².
- C₂₂H₁₄ClNO₂ Benzamide, *N*-*α*-(*α*-chlorophen-acyl)benzyl-, 3888⁴.
- C₂₂H₁₄N₂O Quinoxaline, 5-methoxy-8-methyl-, 2,3-diphenyl-, 197⁴.
- C₂₂H₁₄N₂O₂ Benzidine, *N,N'*-dimethylphthalyl-, 2891⁴.
- Phthalazinedione, dibenzylidihydro-, 1329¹.
- , dihydroditolyl-, 1329¹.
- C₂₂H₁₄N₂O₂ Benzanilide, *o*'-acetyl-, *O*-benzoyl-oxime, 1119⁴.
- C₂₂H₁₄N₂O₂S Quinoline, 2-anilino-8-methoxy-3-(phenylsulfonyl)-, 1122².
- C₂₂H₁₄N₂O₂ Phthalimide, *N*-[4-(4-amino-*m*-anisyl)-*o*-anisyl]-, and -HCl, 2891⁴.
- Protocatechualdehyde, acetate, benzoate, phenylhydrazone, 1107⁴, 1108¹.
- C₂₂H₁₄N₂ 1,2-Naphthoquinone, bis(phenyl-hydrazone), 582⁴.

- C₂₂H₁₉N₄O₄ Phthalic acid, formylphenylhydrazide, 1329¹.
- C₂₂H₁₉N₄O₄ Succinic acid, α, β -dicyano- α, β -bis-(*p*-nitrophenyl)-, di-Et ester, 1257⁴.
- C₂₂H₁₉N₄O₄ Hydrazone deriv. of compd. from *Drosera binata*, 2047⁶.
- C₂₂H₁₉O Benzopyran, methyl-diphenyl-, 3613^{6,7}.
Phthalan, 1-benzal-2-*p*-tolyl-, 3197¹.
- C₂₂H₁₉O₂ 1,2-Benzopyran, 4-methoxy-2,2-diphenyl-, 3613⁶.
- C₂₂H₁₉O₂ Phthalic acid, dithiol-, dibenzyl ester, 3192⁴; di-*p*-tolyl ester, 3192⁴.
- C₂₂H₁₉O₂ 9-Xanthencarboxylic acid, benzyl-, & Me ester, 3904⁸.
- C₂₂H₁₉O₂ 4,3- β -Naphthopyran-1-*o*-benzoic acid, 1,2-dihydro-3-keto-, Et ester, 3616⁸.
- C₂₂H₁₉O₂ Pyrogallolbenzene, tri-Me ether, 1983¹.
- C₂₂H₁₉O₂ Hydroquinone, 2,5-diphenoxy-, diacetate, 3605⁸.
1,2,4-Naphthalenetriol, 3-phenyl-, triacetate, 1647⁶.
- C₂₂H₁₉O₂ Anthracenetetrol, tetraacetate, 2894⁸.
Isoflavone, 5,7,4'-trihydroxy-2-methyl-, triacetate, 246³.
- C₂₂H₁₉O₂ Kamperide, triacetate, 93⁴.
- C₂₂H₁₉BrO Ether, 2-bromo-1,3-diphenyl-1-indanyl methyl, 3614⁴.
- C₂₂H₁₉N 6,7-Benzquinoline, 8-methyl-2 (2,4-xylyl)-, P 3058⁶.
- C₂₂H₁₉NO Quinoline, 1-benzoyl-1,2,3,4-tetrahydro-2-phenyl-, 914⁸.
- C₂₂H₁₉NO₂ 7- α, β' -Dibenzacridinecarboxylic acid, 5,6,9,10,11,12-hexahydro-, 1123².
- C₂₂H₁₉NO₂ Protocatechuy alcohol, bis(methyl carbonate), naphthylurethane, 2888⁶.
- C₂₂H₁₉N₂O 6-Phenomazine-*N'*-anthranilaldehyde, 5,6-dihydro-*N'*-methyl-, 1641⁴.
- C₂₂H₁₉N₂O₂ *o*-Benzophenetide, *m*-(*m*-nitrobenzamido)-, 1451⁴.
- C₂₂H₁₉N₂O₂ Indoxyl-2,2'-pseudindoxyl, 1-acetyl-2'-hydroxy-7,7'-dimethyl-1'-nitroso-, 3-acetate, 88¹.
- C₂₂H₁₉N₂S 1,4,3-Isothiodiazine, 2,3-dihydro-3,5-diphenyl-2-*o*-(*m* and *p*)-tolylimino-, 3200⁴.
—, 2,3-dihydrophenyl-2-phenyliminotolyl-, 3200^{4,4}.
- C₂₂H₁₉N₂ Pyrimidine, 2,4,6-trianilino-, 2271⁸.
- C₂₂H₁₉ClNO₂ Acetamide, α -chloro-*N*-(β -hydroxy- α, β -triphenylethyl)-, 568⁶.
- C₂₂H₁₉Cl₂N₂O₂ 2-Naphtholdisulfonic acid, chloroaniline salt, 1646⁸.
- C₂₂H₁₉CoN₂S Addn. compd. of Co(SCN)₂ and pyridine, 1235².
- C₂₂H₁₉N₂O₂ Carbonic acid, dithiol-, benzyl phenacyl ester, phenylhydrazone, 391⁴.
- C₂₂H₁₉N₂O₂ Phthalanilide, *N, N'*-dimethyl-, 2891².
 α -Toluanilide, 2-hydroxy-4,6-dimethyl- α -phenylimino-, 1116⁸.
- C₂₂H₁₉N₂O₂S Naphthionic acid, *N*-acetyl-, naphthylamine salt, 3361⁴.
- C₂₂H₁₉N₂O₂ Ketiponitrile, α, δ -bis(3,4-dimethoxyphenyl)-, 1110⁴.
Mucononitrile, α, δ -bis(3,4-dimethoxyphenyl)- β, γ -dihydroxy-, 1110⁴.
- C₂₂H₁₉N₂O₂ Methazonic acid, dibenzoyl-, di-propionyl deriv., 1009⁷.
—, di-*p*-tolyl-, di-Ac deriv., 1100¹.
- C₂₂H₁₉N₂ Quinoline, 6,6'-azobis[2,4-dimethyl-, 402³].
- C₂₂H₁₉N₂O 2,3-Pyrrolidinedione, 1-anilino-5-phenyl-, 3-phenylhydrazone, 2903⁴.
- C₂₂H₁₉N₂O₂ Triphenodioxasine, 3,10-bis(di-methylamino)-, 743⁹.
- C₂₂H₁₉N₂O₂ Pyrazine, diacetyldihydro-2,5-dimethyl-3,6-bis(*o*-nitrophenyl)-, 75⁴.
- C₂₂H₁₉N₂O₂ 2-Naphtholdisulfonic acid, *m*-nitroaniline salt, 1646⁸.
- C₂₂H₁₉N₂O₂ Glyoxal, (2-hydroxy-3,5-xylyl)-, *p*-nitrophenyloxazone, 1117⁷.
- C₂₂H₁₉O Acetophenone, α, α -di-*p*-tolyl-, 578⁸.
Ether, ethyl triphenylvinyl-, 3902⁸.
- C₂₂H₁₉O₂ 2-Chromanol, 3-methyl-2,4-diphenyl-, 3613⁷.
Phenol, *p*- α -ethylbenzyl-, benzoate, 1982⁸.
Quinone, 2,5-di-2,5-xylyl-, 2886⁸.
o-Toluic acid, α, α -diphenyl-, Et ester, 1647⁸.
- C₂₂H₁₉O₂ Quinone, 2,5-di-*p*-phenetyl-, 2886⁸.
- C₂₂H₁₉O₂ 2(1)-Benzofuranone, 1-benzal-5,6-dihydroxy-4-isopropyl-, diacetate, 1984⁸.
- 3-Pentadienone, 1-(4-hydroxy-*m*-anisyl)-5-salicyl-, diacetate, 3608⁴.
- C₂₂H₁₉O₂ Ferulic acid, ferulate, acetate, 1257⁴.
- C₂₂H₁₉O₂ 2(1)-Benzofuranone, 3,5-dihydroxy-1-*p*-hydroxybenzyl-4-methoxy-(?), triacetate, 3051¹.
Chrysin, 3,3',4'-trimethoxy-, diacetate, 93¹.
Coumarin, 5,7 (and 7,8)dihydroxy-4-(3,4,5-trimethoxyphenyl)-, diacetate, 1981^{4,4}.
 $\Delta^{1(2)}$, α -Furanacetic acid, α, α -bis(3,4-dimethoxyphenyl)-3-hydroxy-5-keto-, 1110⁴.
- C₂₂H₁₉O₂ Carminic acid, 1127⁴.
- C₂₂H₁₉BrN₂O₂ Creosol, α -[4-(4-aminotolyl)tolylimino]-6-bromo-, 2258³.
- C₂₂H₁₉ClO₂ Methane, tri-*o*-anisylchloro-, 1982⁸.
- C₂₂H₁₉NO Acetophenone, α, α -di-*p*-tolyl-, oxime, 578⁸.
- C₂₂H₁₉NO₂U + 5H₂O Methylamine trisalicylatouranate, 2231⁴.
- C₂₂H₁₉N₂O₂ Butyric acid, γ -anilino- α -keto- γ -phenyl-, phenylhydrazide, 2903⁴.
5- γ -isobenzophenoxazine, 5-(acetylimino)-9-diethylamino-, *II*C¹, 744¹.
- C₂₂H₁₉N₂O₂ *o*-Benzophenetide, *m*-(*m*-aminobenzamido)-, 1451⁴.
- C₂₂H₁₉N₂O₂S 6a(11b)- γ -Benzocarbazolesulfonic acid, 2-hydroxy-(?), PhNHNH₂ salt, 1650⁸.
- C₂₂H₁₉N₂O₂U + 6H₂O Guanidine trisalicylatouranate, 2231⁴.
- C₂₂H₁₉N₂O₂ Acetamidine, *N*-ethyl-*N, N'*-diphenyl-, picrate, 1446¹.
- C₂₂H₁₉N₂O₂ Hydrocinnamanilide, α -amino-*N*-methyl-, picrate, 3355¹.
- C₂₂H₁₉O Methyl, tri-*o*-anisyl-, 1982⁷.
- C₂₂H₁₉ClN₂O₂ 10- α -Isobenzophenoxazine, 5-acetamido-10-(ethylimino)-, ethochloride, 744¹.
- C₂₂H₁₉CoO₂ Acrylophenone, β -hydroxy-2,4 (and 3,4)-dimethoxy-, Cu deriv., 3620^{4,4}.
- C₂₂H₁₉IrN₂O₂ Ethylenediamine, iridipicrate, 3571⁸.
- C₂₂H₁₉N₂O₂ Compd., m. 95°, from 2-benzoyloxy-2-methyl-5-phenyl-3(2)-pyrrolone and EtOCON:CO, 1106⁴.
- C₂₂H₁₉N₂O₂ Hydrohydrastinine, 3-methyl-1-(6-nitro- α -vinylpiperonyl)-, and salts, 1990⁴.
- C₂₂H₁₉N₂O₂ 2-Naphtholdisulfonic acid, aniline salt, 1646⁸.
- C₂₂H₁₉N₂O 2-Propanone, 1,3-diphenyl-, 4-anilinoisemicarbazone, 69¹.
- C₂₂H₁₉N₂O₂ *p*-Phenylenediamine, *N, N'*-bis(α -nitromethylbenzyl)-, and salts, 2253⁸.
- C₂₂H₁₉N₂O₂ Dibenzylidimethylammonium picrate, 73⁷.

- $C_{22}H_{28}N_2O_4$: Carbonic acid, dithiol-, Me phenacyl ester, bisphenylhydrazone, 391¹.
- $C_{22}H_{28}O_2$: 1,2-Ethanediol, 2-phenyl-1,1-di-*p*-tolyl-, 575².
- 1,2-Propanediol, 2-benzyl-1,3-diphenyl-, 567².
- $C_{22}H_{28}O_2$: Methane, tri-*o*-anisyl-, 1982⁶.
- $C_{22}H_{28}O_4$: Carbinol, tri-*o*-anisyl-, 1982⁶.
- $\Delta^1,4,3,4$ -Hexadienediol, 1,6-diphenyl-, diacetate, 3188².
- Muconic acid, β,γ -diphenyl-, di-Et ester, 1632².
- $C_{22}H_{28}O_{11}$: Benzoic anhydride, 4,4'-bis(carbethoxyoxy)-3,3'-dimethoxy-, 93⁴.
- Scoparin, 575².
- $C_{22}H_{28}BrO_2$: $\Delta^1,4,4$ -Butenedione, 2-bromo-1,4-di-2-mesityl-, 82².
- $C_{22}H_{28}ClO_2$: 2-Methyl-4,0-dixilylpyrylium perchlorate, 1814².
- $C_{22}H_{28}ClO_6$: 4'- β -Glucosidoxy-5,7-dihydroxy-3-methoxyflavylum chloride, 3195¹.
- $C_{22}H_{28}N$: Aniline, *N,N*-dimethyl-3,5-di-*p*-tolyl-, 1814¹.
- $C_{22}H_{28}NO_2$: 2,3-Pyrrolidine, 1-cyclohexyl-4,5-diphenyl-, 2882².
- $C_{22}H_{28}NO_4$: Benzylethylhydroxyphenylammonium benzoate, 65².
- Benzylhydroxymethyl-*p*-tolylammonium benzoate, 65².
- $C_{22}H_{28}NO_7$: See *Narcotine*.
- $C_{22}H_{28}NO_8$: Narcotine oxide, 247².
- $C_{22}H_{28}N_2$: Cyclohexylamine, *N*-(*p*-2-naphthylazophenyl)-, 1102⁴.
- $C_{22}H_{28}N_2O_3$: 5-Pyrazolone, 3-methyl-1-phenyl-4-(1,2,3,4-tetrahydro-2,3-dimethyl-6,7-methylenedioxy-1-isoquinolyl)-, 1990⁴.
- $C_{22}H_{28}N_2O_4$: 5-Pyrazolone, 3-methyl-1-phenyl-4-(1,2,3,4-tetrahydro-8-methoxy-2-methyl-6,7-methylenedioxy-1-isoquinolyl)-, and -HCl, 1990⁴.
- $C_{22}H_{28}N_2O_7$: Benzamide, *N*-[β -(4-hydroxycyclohexyl)ethyl]-*p*-nitro-, *p*-nitrobenzoate, 1805⁷.
- $C_{22}H_{28}N_2O_{11}$: Gallaldehyde, tris(ethyl carbonate), *p*-nitrobenzoate, 2886².
- $C_{22}H_{28}BrN_2O_2$: Quinine, bromocyanide, 3055².
- $C_{22}H_{28}BrO_2$: 1,4-Butanedione, 2,3-dibromo-1,4-di-2-mesityl-, 82².
- $C_{22}H_{28}Cl_2O_2$: 1,4-Butanedione, 2,3-dichloro-1,4-di-2-mesityl-, 82².
- $C_{22}H_{28}IP$: Dibenzylethylphenylphosphonium iodide, 66².
- $C_{22}H_{28}N_2O_3$: $\Delta^1,3$ -Cyclopentenedicarboxanilide, 4,5,5-trimethyl-, 1259².
- Strychnine, methyl-, 3366⁷.
- $C_{22}H_{28}N_2O_2$: Barbituric acid, 1,3-diphenyl-5,5-dipropyl-, 3351².
- $C_{22}H_{28}N_2O_7$: Leucine, *N*-(α -benzamidocinnamyl)-, 1813².
- $C_{22}H_{28}N_2O_8$: Benzenecarbarbic acid, *o,o'*-vinylidenebis-, tetra-Me ester, 1124¹.
- $C_{22}H_{28}O_2$: 1,2,4-Butanetriolone, 1,4-di-2-mesityl-, 82².
- $\Delta^1,4,4$ -Butenedione, 2-hydroxy-1,4-di-2-mesityl-, 82².
- $C_{22}H_{28}O_4$: β -Hydromuconic acid, β,γ -diphenyl-, di-Et ester, 1632².
- $C_{22}H_{28}O_5$: 8-Pentadienone, 1,5-bis(3,4-dimethoxyphenyl)-2-methyl-, 1808⁴.
- $C_{22}H_{28}O_{11}$: Tectoridin, 3050².
- $C_{22}H_{28}BrN_2O_2$: Strychnine, methobromide, 3365².
- $C_{22}H_{28}ClN_2O_2$: Normethylstrychnine, methochloride, 3366⁷.
- $C_{22}H_{28}Cl_3N_2O_4$: Quinidine, trichloroacetate, 3905².
- Quinine, trichloroacetate, 3905².
- $C_{22}H_{28}IN_2O_2$: Normethylstrychnine, methiodide, 3366⁷.
- $C_{22}H_{28}N_2O_2$: Quinoline, 1-benzoyl-2-cyclohexyl-1,2,3,4-tetrahydro-, 914².
- $C_{22}H_{28}NO_2$: Butyramide, *N*-cyclohexyl- γ -hydroxy- α -keto- β,γ -diphenyl-, 2882².
- $C_{22}H_{28}NO_4$: 1-Isouquinolineacetic acid, 1,2,3,4-tetrahydro-2,3-dimethyl-6,7-methylenedioxy- α -phenyl-, Et ester, 1990².
- $C_{22}H_{28}NO_6$: See *Cochicine*.
- $C_{22}H_{28}NO_8$: Hydroxy acid, m. 212², from narcotine oxide, and salts, 247².
- $C_{22}H_{28}N_2$: Triphenylamine, *p,p'*-bis(dimethylamino)-, and addn. compds., 2670⁷ &.
- $C_{22}H_{28}BrN_2$: Condensation product, m. 240², from PhNH₂ and 2-(5-bromomethylmethyl-2-pyrrylmethylene)ethylmethylisopyrrole, 103⁷.
- $C_{22}H_{28}N_2O$: Pseudostrychnidine, methyl-, and -HCl, 3365², 3366¹.
- $C_{22}H_{28}N_2O_2$: 1,2-Cyclohexanediaceanilide, 1112⁷.
- 1,3-Cyclopentanedicarboxanilide, 4,4,5-trimethyl-, 1259².
- $C_{22}H_{28}N_2O_3$: Benzamide, *N*-cyclohexyl-*ar*-nitro-*N*-(γ -phenylpropyl)-, 2882².
- $C_{22}H_{28}N_2O_4$: Piperidine, 1,1'-(3,3'-dinitro-*p*-biphenylene)bis-, 1110².
- $C_{22}H_{28}N_2O_5S$: Sulfone, bis[3-nitro-4-(1-piperidyl)phenyl], 2081².
- $C_{22}H_{28}N_2O_9$: Compd. (so-called di-Et dicyanoglutaconate), 1248², 3889².
- $C_{22}H_{28}O_2$: Diphenic acid, α -methylheptyl ester, 3191¹.
- 3,4-Hexanediol, 1,6-diphenyl-, diacetate, 3188².
- $C_{22}H_{28}O_{11}$: Acetophenone, ω -O-tetraacetyl β -glucosidoxy-, 1268⁴.
- $C_{22}H_{28}O_{12}$: Cresotic acid, tetraacetyl-*d*-glucose ester, 1106².
- , tetraacetyl-*d*-glucosido-, 1106².
- $C_{22}H_{28}BrN_2O$: Strychnine, methobromide, 3365⁷.
- $C_{22}H_{28}BrN_2O_2$: Compd., m. 146–9², from so-called di-Et dicyanoglutaconate, 1248².
- $C_{22}H_{28}ClN_2O_2$: Methylene-strychnidinium chloride, 3366².
- Strychnidine, methochloride, 3365⁷.
- $C_{22}H_{28}IN_2O_2$: Methylenestrychnidinium iodide, 3366².
- $C_{22}H_{28}NO_2$: Corydaline, 1963².
- $C_{22}H_{28}NO_4$: Homophthal-1-amic acid, *N*-(3,4-dimethoxyphenenyl)-2,3-dimethoxy-, Me ester, 1088².
- $C_{22}H_{28}N_2O_2$: Physostigmine, salicylate, 2531¹.
- $C_{22}H_{28}N_2O_4$: Arginine, *N*-(β -phenyl-*N*-salicylal-alanyl)-, 2877¹.
- $C_{22}H_{28}N_2O$: Benzamide, *N*-[ϵ -(1,2,3,4-tetrahydro-2-naphthylamino)amyl]-, 566².
- Pseudostrychnidine, dihydromethyl-, 3366².
- $C_{22}H_{28}N_2O_2$: *p,p'*-Rivaleranilide, 2884².
- $C_{22}H_{28}N_2O_2$: (See also *Vohimbine*.)
- Benzoic acid, *p*-(α -*p*-phenetylminoamyl)-amino-, Et ester, 236⁴.
- , *p*-(α -*p*-phenetylminoisoamylamino)-, Et ester, 236⁴.
- Isyohimbethylamine, and -HCl, 414².
- $C_{22}H_{28}N_2O_4$: Adipic acid, α,β -bis(*p*-methylbenzylamino)-, 412².
- Akuanine, and salts, 3623² &.
- 2-Butanol, 3-benzyl-4-diethylamino-, *p*-nitrobenzoate, -HCl, 1121².
- Corynantheine, -HCl, 588¹.

- C₂₂H₂₆ClN₂O Methylidihydroneostrychnidinium chloride, 3366⁹.
- C₂₂H₂₆FeN₂O₂P, 2232².
- C₂₂H₂₆IN₂O Methylidihydroneostrychnidinium iodide, 3366⁹.
- C₂₂H₂₆N₂O 2-Butanol, 3-benzyl-4-diethylamino-, benzoate, -HCl, 1121².
- C₂₂H₂₆N₂ Benzaldehyde, *p*-dimethylamino-, cyclohexyl-*o*-tolylhydrazone, 1102⁹.
- C₂₂H₂₆N₂O₂ 3-Isophenoxazine, 3-(acetyldiethyl-dihydroimino)-9-diethylamino-, 744¹.
- C₂₂H₂₆N₂O₂ Urea, α -[β -ethyl- β -(hydroxymethyl)- α -methylbutyl]- β -phenyl-, carbanilate, 3347¹.
- C₂₂H₂₆N₂O₂ 1,6-Hexanediamine, *N*-(1,2,3,4-tetrahydro-2-naphthyl)-, picrate, 566⁹.
- C₂₂H₂₆N₂O Isocaproamide, *N*-phenethyl- α -phenethylamino-, -HCl, 1658¹.
- C₂₂H₂₆N₂O₂ 2-Butanol, 3-benzyl-4-diethylamino-, *p*-aminobenzoate, -HCl, 1121².
- C₂₂H₂₆N₂O₂ Piperazine, 1,4-bis(γ -aminopropyl)-, dipicrate, 566⁹.
- C₂₂H₂₆O Cymene, 3,3'-ethylenedioxybis-, 739⁶.
- C₂₂H₂₆O₂S Sulfide, bis(δ -benzyloxybutyl), 1639².
- C₂₂H₂₆O₂ Olivil, alcoholate, 1272².
- C₂₂H₂₆Br₂N₂O₂ Cubebol, dibromide, carbanilate, 577¹.
- C₂₂H₂₆N₂O₂ Cubebol, carbanilate, 577¹.
- C₂₂H₂₆BrN₂O₂ Diethylbis(γ -phenoxypropyl)ammonium bromide, 3355².
- C₂₂H₂₆BrN₂O Morphimethine, acetyltetrahydro- γ -methyl-, methobromide, 1125¹.
- C₂₂H₂₆N₂O₂ Ephedrine, oxalate, 77⁴.
- Pseudoephedrine, oxalate, 77⁴.
- C₂₂H₂₆N₂ Piperazine, 1,4-bis[*p*-(β -aminoethyl)-benzyl]-, and *tetra*-HCl, 566⁹.
- C₂₂H₂₆O₂ Ciloxanic acid, 2702¹.
- C₂₂H₂₆O₂ Biloidanic acid, 1991².
- C₂₂H₂₆ Hypcholestene, 3204².
- C₂₂H₂₆IN₂O₂ [*p*-(β -Carboxyvinyl)phenyl]trimethylammonium iodide, menthyl ester, 907⁹.
- C₂₂H₂₆N₂O₂ Ciloxanic acid, dioxime, 2702¹.
- C₂₂H₂₆O₂ Acid from whale oil, 1366², 1719⁶.
- Clupanodonic acid, 661^{1,2}.
- C₂₂H₂₆O₂ Oxalic acid, bis(decahydro-2-naphthyl) ester, 1112^{4,5}.
- C₂₂H₂₆O₂ Dihydroxy acid from abietic acid, Ac deriv., 298².
- C₂₂H₂₆Cl₂NO Palmitanilide, α , α -dichloro-, 2875⁶.
- C₂₂H₂₆N₂O₂ Pentadecenol, carbanilate, 2874^{1,2}.
- C₂₂H₂₆N₂ Camphor, 6-methyl-, azine, 1809⁶.
- C₂₂H₂₆N₂O₂ Caprylamide, *N*, *N'*-*p*-phenylenebis-, 2884².
- C₂₂H₂₆O Hypcholesterol, 3204².
- C₂₂H₂₆O₂ Acid from whale oil, 1366².
- Bisnorcholanic acid, 590⁹, 591¹.
- Etiocolanic acid, Et ester, 501².
- C₂₂H₂₆O₂ Desoxyciloxanic acid, 2702¹.
- C₂₂H₂₆N₂O Ketone, etiocharyl methyl, semicarbazone, 501².
- C₂₂H₂₆N₂O₂ Cetylamine, *N*-(2,4-dinitrophenyl)-, 1962².
- C₂₂H₂₆Cl₂N₂O₂ Piperazine, 1,4-bis(*N*-chloroacetylleucyl)-2,5-dimethyl-, 383⁹.
- C₂₂H₂₆O₂ Alcohol from bark, 599⁹.
- C₂₂H₂₆O₂ Behenic acid, 1908², 3348⁷.
- C₂₂H₂₆NO Chaulmoogramide, *N*-butyl-, 3900⁶.
- , *N*-isobutyl-, 3900⁶.
- C₂₂H₂₆N₂O₂ Piperazine, 1,4-bis(*N*-glycylleucyl)-2,5-dimethyl-, and *di*-HCl, 383⁹.
- C₂₂H₂₆O₂ Cetoleic acid, 1719².
- Erucic acid, 505², 2662², 3298¹.
- Isorucic acid, and *Zn* salt, 1629².
- C₂₂H₂₆O₂ 1,20-Eicosanedicarboxylic acid, 390⁶.
- 1,16-Hexadecanedicarboxylic acid, di-Et ester, 391¹.
- C₂₂H₂₆O₂ Behenic acid, 506¹.
- Stearic acid, Bu ester, P 593².
- C₂₂H₂₆O₂ Capric acid, *i*-hydroxy-, acetate of the *i*-hydroxycaprate, 894⁴.
- C₂₂H₂₆Br₂O₂ Indigotin, 1-benzoyl-5,7,5',7'-tetrabromo-, 89¹.
- C₂₂H₂₆N₂O₂ Indigo yellow 3 G ciba, 89².
- C₂₂H₂₆N₂O₂ Indirubin, 1-benzoyl-, 89².
- C₂₂H₂₆N₂O₂ 2- γ -Benzocarbazolol, benzoate, 1651¹.
- C₂₂H₂₆N₂O₂ 1,2-Benzacridine, 5,6-dihydro-8-nitro-, picrate, 1123².
- C₂₂H₂₆N₂O₂ Quinaldine, α -(*m*-nitrobenzyl)-, picrate, 586⁹.
- C₂₂H₂₆BrClO Furan, 3-bromo-2-(4-chloro-m-tolyl)-4,5-diphenyl-, 3048².
- C₂₂H₂₆BrN₂O Benzamide, *N*-(4-(*o*-bromophenylazo)-1-naphthyl)-, 113².
- C₂₂H₂₆ClN₂O Benzamide, *N*-[(*o*-chlorophenylazo)-1-naphthyl]-, 113².
- C₂₂H₂₆N₂O₂ Quinoline, 3-(*o*-carboxyanilino)-4-(*o*-carboxyphenyl)-, 89².
- C₂₂H₂₆N₂O₂ Glyoxylohydroxamic acid, oxime, tri-Bz deriv., 1097⁹.
- C₂₂H₂₆O₂ 1,4-Naphthoquinone, 2-benzohydryl-3-hydroxy-, 241².
- , 2-benzohydroxyloxy-, 241².
- C₂₂H₂₆O₂ 7-*meso*-Benzanthrone, trihydroxy-, triacetate, 2894⁷.
- C₂₂H₂₆O₂ $\Delta^2(1)$ - α -Furanacetic acid, 3 hydroxy-5-keto- α ,4-bis(3,4-methylenedioxyphenyl)-, Me ester, acetate, 1110².
- C₂₂H₂₆BrN₂O Salicylaldehyde, [(*p*-bromophenylazo)-1-naphthyl]hydrazone, 380⁹.
- C₂₂H₂₆BrO Furan, 3-bromo-4,5-diphenyl-2-*p*-tolyl-, 3048².
- C₂₂H₂₆Br₂O Furan, 2-*p*-anisyl-3-bromo-4,5-diphenyl-, 3048².
- 1-Indenol, 2-bromo-1,3-diphenyl-, acetate, 3614².
- C₂₂H₂₆ClN₂O Benzaldehyde, *p*-hydroxy-, [4-(*o*-chlorophenylazo)-1-naphthyl]hydrazone, 1114¹.
- Salicylaldehyde, [(chlorophenylazo)-1-naphthyl]hydrazone, 380⁹, 1114¹.
- C₂₂H₂₆ClO₂ Δ^1 -1,4-Butenedione, 1-(4-chloro-m-tolyl)-3,4-diphenyl-, 3048².
- C₂₂H₂₆ClO₂ 5,7-Dihydroxy-4'-methoxyflavylium chloride, monobenzoate, 3620⁷.
- 2-(2,4-Dihydroxyphenyl)-4,6-bis(*p*-hydroxyphenyl)pyrylium chloride, 410².
- C₂₂H₂₆ClO₂ 2,6-Bis(2,4-dihydroxyphenyl)-4-(*p*-hydroxyphenyl)pyrylium chloride, 411¹.
- 2,4-Diphenyl-6-salicylpyrylium perchlorate, 410².
- 4-(*p*-Hydroxyphenyl)-2,6-diphenylpyrylium perchlorate, 411¹.
- C₂₂H₂₆Cl₂OP Phosphine, dichloro[α -(1 and 2)-naphthylbenzohydroxyloxy]-, 671¹.
- C₂₂H₂₆NO 1-*meso*-Anthrapyrrrol-6(2)-one, 2-xylyl-, 2684².
- Benzimidic acid, *N*-1-naphthyl-, Ph ester, 3190².
- Pyridine, 2,4,6-triphenyl-, *N*-oxide, and -HCl, 94⁹.
- C₂₂H₂₆NO₂ 1-*meso*-Anthrapyrrrol-6(10b)-one, 10b-hydroxy-2-xylyl-, 2685².
- Anthraquinone, 1-(α -iminodimethylbenzyl)-, 2685².
- C₂₂H₂₆NO₂ Anthraquinone, 1-xylyl-, oxime, 2684².
- 1-Anthraquinonecarboxylylide, 2685².

- Carbostyryl, 4-hydroxy-1-methyl-3-phenyl(-), benzoate, 1987⁴.
- 2,4-Quinolinediol, 3-benzyl-, monobenzoate, 1987⁴.
- , 8-methyl-3-phenyl-, monobenzoate, 1987⁴.
- 4(1) - Quinolone, 2-hydroxy-1-methyl-3-phenyl(-), benzoate, 1987⁴.
- C₂₂H₁₇N₃O₂ Acridinamide, 2697³.
- Indole, 3,3'-*m*-nitrobenzylbis-, 1118⁸.
- C₂₂H₁₇N₃O₄ Resorcinol, [(4-nitro-*o*-tolylazo)-1-naphthylazo]-, 380⁸.
- C₂₂H₁₅Cl₂ Anthracene, 1,5-dichloro-9,10-dihydro-9-phenyl-10-propylidene-, 3191⁸.
- , 1,5-dichloro-9-isopropyl-10-phenyl-, 3191⁸.
- , 1,5-dichloro-9-phenyl-10-propyl-, 3191⁸.
- C₂₂H₁₅NO 1-*meso*-Anthrapyrryl-6-ol, 1,2,6,10b-tetrahydro-2-xylyl-, 1,6,10b-trivalent radical, 2684⁴.
- C₂₂H₁₅N₂ Cyclopent[3,2- α]quinoxaline, 8,9-dihydro-2,3-diphenyl-, 85².
- C₂₂H₁₅N₂O₂ Coumarin, 3-benzoylmethyl-, phenylhydrazine, 378⁸.
- C₂₂H₁₅N₂O₂ 2-Benzofurandione, 3,5-dimethyl-, benzoylphenylhydrazine, 1116⁴.
- C₂₂H₁₅N₂ Imidazoquinoxaline, 1,2-dimethyl-6,7-diphenyl-, 2691⁷.
- C₂₂H₁₅N₂O₂ Quinoline, 6,8-dimethyl-2-phenyl-, picrate, 3622⁸.
- C₂₂H₁₅N₂O₂ Quinoline 2-*p*-anisyl-6-methyl-, picrate, 3622⁸.
- C₂₂H₁₅N₂O₂ Isoquinoline, 6,7-dimethoxy-1-phenyl-, picrate, 1655⁸.
- C₂₂H₁₅N₂O₂ Pyrimidine, 4-anilino-6-methyl-2-phenyl-, picrate, 97⁴.
- C₂₂H₁₅O₂ Benzohydrol, α phenylethynyl-, acetate, 1980⁸.
- Δ^2 -1,4-Butenedione, 3,4-diphenyl-1-*p*-tolyl-, 3048².
- C₂₂H₁₅O₂ Δ^2 -1,4-Butenedione, 1-*p*-anisyl 3,4-diphenyl-, 3048².
- C₂₂H₁₅O₄ Pyrocatechol, 3-allyl-, dibenzoate, 3192⁸.
- C₂₂H₁₅O₁₀ Umbelliferone, 4-(3,4,5-trihydroxyphenyl)-, tetraacetate, 1981².
- C₂₂H₁₅ClO₂ 3-(3,4-Dimethoxystyryl)- β -naphthopyrylium chloride, 1267⁷.
- C₂₂H₁₅Cl₂N Aniline, *p*-(1,5-dichloro-9-anthrylmethyl)-*N,N*-dimethyl-, 1260⁴.
- C₂₂H₁₅NO₄ Benzanilide, *N*-acetyl-*p'*-(*p*-hydroxyphenyl)-, acetate, 238⁸.
- C₂₂H₁₅N₂O 4-Pyrazolecarboxanilide, 3(or 5)-methyl-1,5(or 1,3)-diphenyl-, 734².
- C₂₂H₁₅N₂O₂ Acetanilide, *o*-[[α -(*o*-formylphenylimino)-*o*-tolylimino]methyl]-, and -*II*C, 761².
- C₂₂H₁₅N₂O₄ Benzoic acid, *p*-[*m*-(*m*-nitrobenzamido)benzamido]-, Et ester, 1451⁸.
- C₂₂H₁₅O₂P Methanephosphonic acid, 1(and 2)-naphthylidiphenyl-, and *di-K salt*, 671².
- C₂₂H₂₀ Anthracene, 9-isopropyl-10-phenyl-, 3191⁸.
- , 9-phenyl-10-propyl-, 3191⁸.
- C₂₂H₂₀ClNO 3-(*p*-Dimethylaminostyryl)- β -naphthopyrylium perchlorate, 1267⁷.
- C₂₂H₂₀N₂O 2-Pyrrolidone, 1,5-diphenyl-3-*p*-tolylimino-, 2903¹.
- C₂₂H₂₀N₂O₂ 1,2-Benzofurandione, 3,5-dimethyl-, benzylphenylhydrazine, 1116⁴.
- C₂₂H₂₀N₂O₂ Quinoline, 2-anilino-8-methoxy-3-*p*-tolylsulfonyl-, 1122².
- C₂₂H₂₀N₂O₄ Glyoxylic acid, (6-hydroxy-2,4-xylyl)-, benzoylphenylhydrazine, 1116⁴.
- 2-Propanone, 1,3-dihydroxy-, dibenzoate, phenylhydrazine, 1797⁴.
- C₂₂H₂₀N₂O₂ Quinoline, 2-anilino-3-(*o*-anisylsulfonyl)-8-methoxy-, 1122².
- C₂₂H₂₀N₂O₂ 1,3,4-Triazole-2-mercaptan, 5-*p*-toluino-1-*p*-tolyl-, benzoyl deriv., 2900⁸.
- C₂₂H₂₀N₂O₄ Chelidonic acid, 3,5-bis(phenylazo)-, di-Et ester, 3192⁸.
- C₂₂H₂₀N₂ Naphthyridine, 2,7-bis(benzalhydrizino)-4-methyl-, 586⁷.
- C₂₂H₂₀O 1,2-Benzopyran, 4,6(and 4,7)-dimethyl-2,2-diphenyl-, 3613⁸.
- C₂₂H₂₀O₂ Benzoin, α -benzyl-, acetate, 379⁸.
- C₂₂H₂₀O₂ 2-Naphthoic acid, 1,4-dihydroxy-3-phenyl-, Et ester, diacetate, 1647⁸.
- C₂₂H₂₀O₂ Δ^2 (β)- α -Furanacetic acid, α ,4-di-*o*-anisyl-3-hydroxy-5-keto-, Me ester, acetate, 1116⁴.
- C₂₂H₂₀ClO₄ Δ^2 -Cyclohexenecarboxylic acid, 4-[*o*(*m* and *p*)-chlorostyryl]-2-keto-6-salicyl-, Et ester, 2258².
- C₂₂H₂₀N₂O Acenaphthopyridine, 10-benzoyl 7,8,9,10-tetrahydro-9-methyl-, 910⁸.
- C₂₂H₂₀N₂O₂ Carbamic acid, diphenyl-, 5,6,7,8-tetrahydro-2-naphthyl ester, 1983⁷.
- Quinoline, 1-benzoyl-1,2,3,4-tetrahydro-8-methoxyphenyl-, 3771².
- C₂₂H₂₀N₂O 6-Phenhomazine-*N'*-anthranilaldehyde, *N'*-ethyl-5,6-dihydro-, 1641⁴.
- C₂₂H₂₀N₂O₂ 1,4,3-Isotiodiazine, 2-(*o*-anisylimino)-2,3-dihydro-5-phenyl-3-*p*-tolyl-, 3200⁸.
- C₂₂H₂₀N₂O₄ Benzoic acid, *p*-[*m*-(*m*-aminobenzamido)benzamido]-, Et ester, 1451⁸.
- C₂₂H₂₀N₂S 1,4,3-Isotiodiazine, 2,3-dihydrophenyltolyl-2-tolylimino-, 3200⁸.
- , 2,3-dihydro-2-phenylimino-3-*m*-tolyl-5-*p*-tolyl-, 3200⁸.
- C₂₂H₂₀BrN₂O₂ Hydrazinesulfonic acid, β -[4-(*o*-bromophenylazo)-1-naphthyl]-, *p*-toluidine salt, 1114².
- C₂₂H₂₀Br₄O₂ 3-Pentanone, 1,2,4,5-tetrabromo 1,5-bis(4-hydroxy-*m*-anisyl)-, diacetate, 3609⁴.
- C₂₂H₂₀ClN₂O₂ Hydrazinesulfonic acid, β -[4-(*o*-chlorophenylazo)-1-naphthyl]-, *p*-toluidine salt, 1111².
- C₂₂H₂₀N₂O Diimide, α -isobutyl- β -triphenylmethyl-, 1455⁸.
- C₂₂H₂₀N₂O₂ Codeone, dihydrohydroxy, phenylhydrazine, 2698⁴.
- C₂₂H₂₀N₂O₄ 4-Pyridinecarboxylic acid, 2,5-dihydro-3-hydroxy-5-keto-2-phenyl-, Et ester, acetate, acetylphenylhydrazine, 1973⁴.
- C₂₂H₂₀N₂O₂ 2,3-Benzacridine, 1,2,3,4,7,8,9,10-octahydro-, picrate, 1123².
- Xanthochelidonic acid, β ,6-bis(phenylazo)-, di-Et ester, 3192⁸.
- C₂₂H₂₀O 9-Anthrol, 9,10-dihydro-10-phenyl-9-propyl-, 3191⁸.
- Butyrophene, α -benzyl- α -phenyl-, 1626⁸.
- Ether, ethyl β , γ , γ triphenylallyl, 3902².
- C₂₂H₂₀O₂ Δ^2 -1-Butenol, 3-(2,4-cresyl)-1,1-diphenyl-, 3613⁸.
- Isobutyric acid, β , β' -diphenyl-, *p*-tolyl ester, 1117².
- C₂₂H₂₀O₂ 2,6-Xylenolsulfonephthalcin, 1111².
- C₂₂H₂₀O₂ 3-Pentadecanone, 1,5-bis(4-hydroxy-*m*-anisyl)-, diacetate, 3609⁴.
- C₂₂H₂₀O₂ Δ^2 -Cyclohexene- Δ^1 - β -propionic acid, α -acetyl-5-benzoyl-5-carboxy-2,6-diketo-, di-Et ester, 1266².

- Ferulic acid, Me ester, ferulate, acetate, 1257⁸.
- C₂₂H₂₂O₉, Δ²(8)-α-Furanacetic acid, α,4-bis(3,4-dimethoxyphenyl)-3-hydroxy-5-keto-, Me ester, 1110⁸.
- C₂₂H₂₂ClO₄, Methane, chlorobis(2,4-dimethoxyphenyl)phenyl-, 1982⁸.
- C₂₂H₂₂Cl₂N₂O₄, Strychnine, trichloroacetate, 3905⁸.
- C₂₂H₂₂N Benzalimine, α-(α-benzyl-α-phenylpropyl)-, 1626⁸.
- C₂₂H₂₂NO Butyropheneone, α-benzyl-α-phenyl-, oxime, 1626⁸.
- Florophenone, β-anilino-*p*-ethyl-β-phenyl-, 398¹.
- , 4-methyl-β-phenyl-β-*p*-toluino-, 398¹.
- C₂₂H₂₂NO Carbamic acid, β-triphenylethyl-, Et ester, 2671¹.
- Phenethylamine, *N*-benzal-4-benzyloxy-3-methoxy-, 96⁸.
- C₂₂H₂₂NO₂ Pyrrole, 1-isoamyl-2,5-dimethyl-3,4-di-*p*-quinonyl(?), 244¹.
- C₂₂H₂₂N₂O Acetophenone, α,α-di-*p*-tolyl-, semicarbazone, 575⁸.
- C₂₂H₂₂N₂ Benzaldehyde, cyclohexyl-2-naphthylhydrazone, 2672⁸.
- C₂₂H₂₂N₂O Isobutyric acid, triphenylmethylhydrazide, 1455⁸.
- C₂₂H₂₂N₂O₂ Benzylamine, *N*-butyl-*N*-phenyl-, picrate, 2884⁸.
- C₂₂H₂₂N₂O₂ Phenethylamine, 4-benzyloxy-3-methoxy-*N*-methyl-, picrate, 96⁸.
- C₂₂H₂₂N₂S Carbonic acid, dithiol-, Et phenacyl ester, bisphenylhydrazone, 391⁸; Me *p*-methylphenacyl ester, bisphenylhydrazone, 391⁸.
- C₂₂H₂₂O₂ Methane, bis(3-methyl-*p*-anisyl)phenyl-, 1645⁸.
- C₂₂H₂₂O₂ Carbinol, bis(2,4-dimethoxyphenyl)phenyl-, 1982⁸.
- , di-*p*-anisyl(2,4-di-methoxyphenyl)-, 1982⁸.
- C₂₂H₂₂Br₂NO Pseudocumenol, 3,6-dibromo-α-(4-diethylamino-1-naphthyl)-, 903¹.
- C₂₂H₂₂ClN₂ See *Malachite green*.
- C₂₂H₂₂NO₂ Capric acid, α-anilino-β-benzoyl-γ-hydroxy-, lactone, 3900⁸.
- C₂₂H₂₂NO₂S Toluenesulfonamide, *N*-(β-hydroxy-γ,γ'-diphenylisobutyl)-, 568⁸.
- C₂₂H₂₂N₂O₂S Benzenesulfonic acid, *p*-(α-*N*-butylamino-*p*-tolylazo-, and *Na* salt, 2884⁸.
- C₂₂H₂₂N₂O₂ 3-Pyrrolicarboxylic acid, 5,5'-(*p*-nitrobenzal)bis[2-methyl-, di-Et ester, 381⁴.
- C₂₂H₂₂N₂O₂ Phenethylamine, *p*-phenethylaminomethyl-, picrate, 566⁷.
- C₂₂H₂₂N₂O₂ 5-Isopyrrolicarboxylic acid, 3,5-dimethyl-2-(3,4,5-trimethyl-2-pyrrolylmethylene)-, Et ester, picrate, 85⁷.
- C₂₂H₂₂BrClN₂O₂ Pyruvic acid, bromochloro-, quinine salt, 3600⁸.
- C₂₂H₂₂N₂O₄ (See also *Brucine*.)
- 3-Pyrrolicarboxylic acid, 5,5'-benzalbis[2-methyl-, di-Et ester, 381⁴.
- Hydrohydrastinine, 3-methyl-1-(6-nitro-*α*-vinylveratryl)-, 1990⁴.
- C₂₂H₂₂N₂O₂ Hydrocotarnine, 1-(6-nitro-*α*-vinylveratryl)-, 1990⁴.
- C₂₂H₂₂O₂ Δ²-1,4-Dutenedione, 1,4-di-2-mesityl-2-methoxy-, 82⁷.
- C₂₂H₂₂O₄ Spiro[cyclohexane-1,1'-cyclopropane-2',1''-cyclohexane-2,6,2'',6''-tetrone, 4,4,4'',4''-tetramethyl-3'-phenyl-, 3203⁸.
- C₂₂H₂₂O₄ 3-Pentadienone, 1,5-bis(3-methoxy-*p*-phenetyl)-, 3612⁸.
- C₂₂H₂₂NO₂ See *Narceine*.
- C₂₂H₂₂N₂O₂ Isopyrrole, 4-ethyl-2-[(4-ethyl-3,5-dimethyl-2-pyrrolylmethylene)-3,5-dimethyl-, picrate, 2701⁸.
- C₂₂H₂₂N₂ Triphenylamine, *p*,*p*'-bis(dimethylamino)-, methiodide, 2670⁷.
- C₂₂H₂₂N₂O₂ Brucidine, and salts, 3366⁸.
- C₂₂H₂₂N₂O₂ Methylstrychnidinium hydrogen carbonate, 3366⁷.
- C₂₂H₂₂N₂O₂ Brucidine, 3367⁸.
- C₂₂H₂₂N₂O₂S Strychnine, methosulfate, 3365⁸.
- C₂₂H₂₂N₂O₂ 1,3-Propanediamine, *N*,*N*'-dinitroso-*N*,*N*'-bis(1,2,3,4-tetrahydro-2-naphthyl)-, 567¹.
- C₂₂H₂₂N₂O₂ Methane, bis[3-nitro-4-(1-piperidyl)phenyl]-, 2681⁴.
- C₂₂H₂₂O Camphor, methyldiphenyl-, 1225¹.
- C₂₂H₂₂O₂ 3-Nonanoic acid, 1-(4-hydroxy-*m*-anisyl)-, benzoate, 3623⁷.
- C₂₂H₂₂O₂ Salicylaldehyde, compd. with dimethyl-1,3-cyclohexanedione, 2253¹.
- 3,6-Spirooctane-1-valeric acid, δ,3,7-triketo-β,β,β,5,5,5-tetramethyl-2-phenyl-, 3203⁸.
- C₂₂H₂₂O₄ Benzoic acid, 4-hydroxy-2,6-dimethoxy(?), tetraacetyl-*d*-glucose ester, 1106².
- Salicylic acid, 4,6-dimethoxy(?), tetraacetyl-*d*-glucose ester, 1106².
- C₂₂H₂₂ClN₂O Pseudostrychnidine, methyl-, methochloride, 3366¹.
- C₂₂H₂₂N₂O Pseudostrychnidine, methyl-, methiodide, 3366¹.
- C₂₂H₂₂N₂O 2-Butanol, 3-benzyl-4-(1-piperidyl)-, benzoate, -HCl, 1121¹.
- C₂₂H₂₂NO₂ Guaiacol, 5-(γ-1-piperidylbutyl)-, benzoate, -HCl, 1449⁸.
- C₂₂H₂₂NO₂ Des-*N*-methylcorydaline, 1963⁷.
- 1,2-Benzoquinoline, 3-ethoxy-5,6,13,13a-tetrahydro-2,9,10-trimethoxy-13-methyl-, and -HCl, 2903⁸.
- C₂₂H₂₂N₂O₂ Brucine, tetrahydro-, nitrosamine, -HCl, 3367¹.
- C₂₂H₂₂Br₂N₂ Spiro[isquinoline-2(1),1'-homopiperazine-4',2''(1'')-isquinoline], 3,4,3'',4''-tetrahydro-*N*,*N*'-dihydroxy-, dibromide, 1653⁴.
- C₂₂H₂₂Cl₂N₂ Spiro[isquinoline-2(1),1'-homopiperazine-4',2''(1'')-isquinoline], 3,4,3'',4''-tetrahydro-*N*,*N*'-dihydroxy-, dichloride, 1653⁴.
- C₂₂H₂₂N₂ 1,3-Propanediamine, *N*,*N*'-bis(1,2,3,4-tetrahydro-2-naphthyl)-, and di-*HBr*, 566⁷.
- C₂₂H₂₂N₂O Benzamide, *N*-[(-1,2,3,4-tetrahydro-2-naphthylamino)hexyl]-, 566⁸.
- C₂₂H₂₂N₂O₂ Strychnidine, methoxymethyldihydro-, and -H₂, 3365⁸.
- C₂₂H₂₂N₂O₂ Strychnidine, oxymethoxymethyldihydro-, 3366¹.
- C₂₂H₂₂N₂O₂ Brucine, tetrahydro-, and salts, 3366⁷, 3367¹.
- C₂₂H₂₂N₂O₂S Strychnidine, methosulfate, 3365⁷.
- C₂₂H₂₂N₂O₂ 3-Pyrrolicarboxylic acid, 2,2'-methylenebis[5-carboxy-4-methyl-, di-Et ester, 104⁴.
- C₂₂H₂₂N₂O₂ Arabinose, *d*-galacto-*d*-, phenylazone, 393⁷.
- C₂₂H₂₂N₂O₂ Strychnidone, disemicarbazone, 3366⁸.

- $C_{21}H_{21}ClN_4O$ Pseudostrychnidine, dihydro-methyl-, methochloride, 3366^a.
- $C_{21}H_{21}N_4O$ Pseudostrychnidine, dihydromethyl-, methiodide, 3366^a.
- $C_{21}H_{21}N_7O_4$ Akuamine, methiodide, 3623^a.
- $C_{21}H_{21}NO_7$ 1,7-Heptanediamine, *N*-(1,2,3,4-tetrahydro-2-naphthyl)-, picrate, 566⁷.
- $C_{21}H_{21}As_2N_4O_7$ *m*-Arsanilic acid, *N,N'*-carbonylbis[4-(1-piperidyl-, and *Mg* salt, 2684^a.
- $C_{21}H_{21}N_3$ Isoindoline, 2-[o-(1-piperidylmethyl)-benzyl]-, dimethiodide, 4101.
- $C_{21}H_{21}N_3O_2$ Strychnidine, tetrahydromethoxymethyl-, and -*HI*, 3366^a.
- $C_{21}H_{21}O_2$ Cymene, 3,3'-trimethylenedioxybis-, 739^a.
- $C_{21}H_{21}O_3$ Dihydromonoanhydrostrophanthidin, 3902^a.
- $C_{21}H_{21}NO_4$ Oxime, m. 248–9°, of tetrahydrodianhydrolactone acid from anhydrostrophanthidin, 90^a.
- $C_{21}H_{21}O$ Muscone, benzylidene-, 901^a.
- $C_{21}H_{21}O_{11}$ Glucoheptoside, pentaacetyl- β -cyclohexanol- α -, 2252¹.
- $C_{21}H_{21}NO_4$ Ketolactammonocarboxylic acid, m. 218–20°, from desoxybilianic acid, 2477².
- $C_{21}H_{21}NO_4$ Ketolactamidicarboxylic acid, m. 277°, from desoxybilianic acid, 3903².
- $C_{21}H_{21}O_2$ Palmitic acid, salicylate, 1328⁹.
- $C_{21}H_{21}O_2$ Bismorcholanolic acid, Me ester, 591¹.
- Norcholanolic acid, 590^a.
- $C_{21}H_{21}O_2$ Alcohol from bark, 599⁹.
- $C_{21}H_{21}N_2O_4$ Azelaic acid, α,η -di-1-piperidyl-, di-Et ester, 59^a.
- $C_{21}H_{21}O_2$ Behenic acid, Me ester, 3348⁷.
- $C_{21}H_{21}O_2$ Erucic acid, Me ester, 2458².
- Isorucic acid, Me ester, 1629^a.
- $C_{21}H_{21}O_2$ Behenic acid, methyl ester, 506⁹.
- $C_{21}H_{21}Cl_2O_4$ $\Delta^7,7'$ -Biacenaphthene[8,8'-dione, 3,3'-dichloro-, 2683^a.
- $C_{21}H_{21}O_7$ Trimethylenetriphenylmethanetriketone-3,3' (and 4,4')-dicarboxylic acid, and tri-*Na* salt, 579^a.
- $C_{21}H_{21}Br_2N_2$ 9,9'-Bicarbazole, 3,6,3',6'-tetrabromo-, 2686^a.
- $C_{21}H_{21}I_2N_2$ 9,9'-Bicarbazole, 3,6,3',6'-tetraiodo-, 2686^a.
- $C_{21}H_{21}ClO_2$ Naphthalfluorescein, α -chloro-, 2683^a.
- $C_{21}H_{21}N_3O_4Te_2$ Phenoxtellurine, 2,8-dinitro-, 2-nitrophenoxtellurine addn. compd., 1251^a.
- $C_{21}H_{21}N_3O_4$ 10(12)- α -Benzophenazinone, 9-hydroxy-5-nitro-12-phenyl-, acetate, 1988^a.
- $C_{21}H_{21}O_2Cl_2P_2$ Phosphorus monochloride, dipyrocatechyl-, dimer, 3057¹.
- $C_{21}H_{21}N_2$ Bicarbazole, 913^a, 2687¹.
- $C_{21}H_{21}N_2O_2$ Biphenyl, 3,3'-dinitro-4,4'-diphenoxy-, 379^a.
- $C_{21}H_{21}N_4O$ 12-Isoquinoxala[2,3- β]phenoxazine, 3-dimethylamino-, 744¹.
- $C_{21}H_{21}N_4O_2$ 2-Pyranobenzoquinolone, 4,7-dimethyl-, picrate, 411¹.
- $C_{21}H_{21}N_4$ 1,2,3-Benzotriazole, 1,1'- β -biphenylenebis-, 913^a.
- $C_{21}H_{21}N_3O$ 2,1,3-Benzotriazol-5-ol, 2-phenyl-4-[2-phenyl-5-(2,1,3-benzotriazolyl)-azo], 2689².
- $C_{21}H_{21}N_4O_{11}$ Ketone, *p*-aminophenyl-2-pyridyl, dipicrate, 94¹.
- $C_{21}H_{21}O_2$ Benzoic acid, *o*-benzoyl-, mixed anhydride with β -benzoylacrylic acid, 2259^a.
- $C_{21}H_{21}O_{10}$ Isophthalic acid, 4,4'-(*o*-carboxybenzal)bis-, 579^a.
- Terephthalic acid, 2,2'-(*o*-carboxybenzal)bis-, 579^a.
- $C_{21}H_{21}O_8S_4Te_2$ Phenoxtellurine, cyclic 10,10'-disulfate, 1104⁷.
- $C_{21}H_{21}Br_2N_4O_4$ Compd., m. 251°, from benzidine and 4,4'-dibromo-3,3'-dinitrobiphenyl, 2681^a.
- $C_{21}H_{21}ClN_4O_2$ Creosol, 6-chloro- α -(2-naphthyl-imino)-, picrate, 906⁹.
- $C_{21}H_{21}NO_4$ Pyrrole, 2,5-dimethyl-1-phenyl-3,4-di-*p*-quinonyl-(?), 244^a.
- $C_{21}H_{21}N_3O_3$ Isacene, 3708¹.
- $C_{21}H_{21}N_3NO_3$ 3,4-Benzofluorindine, 5-acetamido-, 2272⁷.
- $C_{21}H_{21}$ Biphenyl, *o,o'*-diphenyl-, 3047^a.
- $C_{21}H_{21}As_2N_2$ 1,1'(8,6')-Biphenarsazine, 98^a.
- $C_{21}H_{21}BrNO$ Pyridine, 6-*p*-anisyl-2-bromo 3,4-diphenyl-, 1651^a.
- $C_{21}H_{21}BrNO_8S$ Quinaldine, α -benzal-3-(*p*-bromophenylsulfonyl)-8-methoxy-, 412¹.
- $C_{21}H_{21}CdN_4O_6$ Azoxybenzene, *p*-nitrosohydroxylamine, cadmium deriv., 3048^a.
- $C_{21}H_{21}ClNO_8S$ Quinaldine, α -benzal-3-(*p*-chlorophenylsulfonyl)-8-methoxy-, 412¹.
- $C_{21}H_{21}CoN_4O_6$ Azoxybenzene, *p*-nitrosohydroxylamine, cobalt deriv., 3048^a.
- $C_{21}H_{21}CuN_4O_6$ Azoxybenzene, *p*-nitrosohydroxylamine, copper deriv., 3048^a.
- $C_{21}H_{21}CuO_6$ Valeric acid, β -benzoyl- γ -hydroxy- α -keto-, lactone, Cu deriv., 3909^a.
- $C_{21}H_{21}HgN_4O_6$ Azoxybenzene, *p*-nitrosohydroxylamine, mercury deriv., 3048^a.
- $C_{21}H_{21}N_2O_2$ Indole, 3,3'-piperonylidenebis-, 1118^a.
- Naphthalanilide, 2682⁹.
- $C_{21}H_{21}N_2O_2$ Cinchophen, 6-(*p*-acetamidophenyl)-, 2473^a.
- $C_{21}H_{21}N_2O_2$ Benzoic acid, *p*-[3-(*p*-carboxyphenylimino)-2-keto-5-phenyl-1-pyrrolidyl]-, 2903¹.
- $C_{21}H_{21}N_4O_4$ Benzidine, *N,N'*-bis(*o*-nitrophenyl)-, 913^a.
- , 2,2'-dinitro-*N,N'*-diphenyl-, 379^a.
- $C_{21}H_{21}N_4NiO_6$ Azoxybenzene, *p*-nitrosohydroxylamine, nickel deriv., 3048^a.
- $C_{21}H_{21}N_4O_6Pb$ Azoxybenzene, *p*-nitrosohydroxylamine, lead deriv., 3048^a.
- $C_{21}H_{21}N_4O_6Zn$ Azoxybenzene, *p*-nitrosohydroxylamine, zinc deriv., 3048^a.
- $C_{21}H_{21}N_4O_{11}$ Pyridine, 2 (and 4)-(*p*-aminobenzyl)-, dipicrate, 94¹.
- $C_{21}H_{21}O_2$ 1,3- Δ^4 -Cyclopentenedione, 4-benzyl-2,5-diphenyl-(?), 1804^a.
- Ketone, bis[2(or 7)-methyl-1-naphthyl], 1643⁷.
- 2,2'-Spiro[1,2-benzopyran], 3-benzyl-, 2900^a.
- $C_{21}H_{21}O_2$ 2-*o*-Quinopyran, 6-(2,4-cresyl)-4-phenyl-, 410^a.
- $C_{21}H_{21}O_2$ Isoflavone, 5,7-dihydroxy-4'-methoxy-2-styryl-, 246^a.
- $C_{21}H_{21}O_5S_4Te_2 + H_2O$ 10,10'-Biphenotelluroxonium 5-hydroxide 5-bisulfate, 1104⁷.
- $C_{21}H_{21}O_5S_4Te_2$ 10,10'-Biphenotelluroxonium 5,5'-disulfate, 1104⁷.
- $C_{21}H_{21}BrN_4$ *p*-Tolualdehyde, [4-(*o*-bromophenylazo)-1-naphthyl]hydrazone, 1114^a.
- $C_{21}H_{21}BrN_4O$ Anisaldehyde, [4-(*o*-bromophenylazo)-1-naphthyl]hydrazone, 1114^a.
- $C_{21}H_{21}BrO$ Furan, 3-bromo-4,5-diphenyl-2-(3,4-xylyl)-, 3048^a.
- $C_{21}H_{21}ClN_4O$ Anisaldehyde, [4-(*o*-chlorophenylazo)-1-naphthyl]hydrazone, 1114^a.

- Benzaldehyde, *m*-methoxy-, [4-(*o*-chlorophenylazo)-1-naphthyl]hydrazone, 1114¹.
- C₂₄H₁₈ClO₂ 3-Benzyl-2-(*o*-hydroxystyryl)benzopyrylium chloride, 2900⁹.
- 2-(2,4-Cresyl)-4,6-diphenylpyrylium chloride, and *HCl*, 410⁸.
- C₂₄H₁₈ClO₂ 2-(2,4-Cresyl)-4-phenyl-6-salicylpyrylium chloride, 410⁸.
- C₂₄H₁₈ClO₄ Anisylidiphenylpyrylium perchlorate, 410⁸, 411¹.
- 3-Benzyl-2-(*o*-hydroxystyryl)benzopyrylium perchlorate, 2000⁹.
- 2-(2,4-Cresyl)-4,6-diphenylpyrylium perchlorate, 410⁸.
- C₂₄H₁₈ClO₂ 2-(2,4-Cresyl)-4-phenyl-6-salicylpyrylium perchlorate, 410⁸.
- C₂₄H₁₈Cl₂FeO₃ 3-Benzyl-2-(*o*-hydroxystyryl)benzopyrylium ferric chloride, 2900⁹.
- C₂₄H₁₈NO Pyridine, 2-(2,4-cresyl)-4,6-diphenyl-, 410⁸.
- C₂₄H₁₈NO₂ Benzoju, α -1-naphthyl-, oxime, 3356².
- Pyridine, 2-(2,4-cresyl)-4-phenyl-6-salicyl-, 410⁸.
- 2-Pyridol, 6-*p*-anisyl-3,4-diphenyl-, 1651⁴.
- C₂₄H₁₈NO₂S Quinaldine, α -benzal-8-methoxy-3-(phenylsulfonyl)-, 41⁸.
- C₂₄H₁₈NO₂ See *Isacen*.
- C₂₄H₁₈N₂ 1-Cyclopentaquinoxaline, 3-(*N*-methyl-anilino)-1-phenyl-, 1106⁸.
- C₂₄H₁₈N₂O 2-Naphthol, 1-(5-nitro-6-*p*-toloxy-m-tolylazo)-, 2885².
- C₂₄H₁₈N₂O₂ Salicylaldehyde, [(5-nitro-*o*-tolylazo)-1-naphthyl]hydrazone, 381¹.
- C₂₄H₁₈O₂P Triphenyl *o* phenylene orthophosphate, 3057².
- C₂₄H₁₈As₂O Arsenic, diphenyl-, oxide, 3612⁴.
- C₂₄H₁₈BrNO₂ 2-Pyridol, 2-*p*-anisyl-6-bromo 2,3-dihydro-4,5-diphenyl-, 1651⁴.
- C₂₄H₁₈BrN₂O Pseudocumenol, 3,6-dibromo α -(3,5-diphenyl-1-pyrazolyl)-, 903².
- C₂₄H₁₈ClN₂O 9- γ Isobenzophenoxazine, 5-anilino-9-methylimino-, methochloride, 743².
- C₂₄H₁₈Ge Germane, tetraphenyl-, 878⁷, 904⁸.
- C₂₄H₁₈N₂ Benzidine, diphenyl-, 672¹.
- C₂₄H₁₈N₂O Crotonamide, Δ naphthyl- β 1-naphthylamino-, 96⁸.
- C₂₄H₁₈N₂O₂ 2-Naphthol, 1-(5-*p*-toloxy-*o*-tolylazo)-, 2885².
- C₂₄H₁₈N₂O₂ Benzidine, *N*, *N'*-dimethylphthalyl-, acetyl deriv., 2891².
- C₂₄H₁₈N₂O₂ Butyronitrile, γ -anisoyl α (*p*-nitrophenyl)- β -phenyl-, 1651⁴.
- C₂₄H₁₈N₂O₂S₂ Disulfoxide, bis(4-acetamido-1-naphthyl)-, 234².
- C₂₄H₁₈N₂O₂ Phthalimide, *N*-[4-(4-acetamido-m-anisyl)-*o*-anisyl]-, 2801³.
- C₂₄H₁₈N₂O₂V Quinoline, vanadylmalonate, 2230⁸.
- C₂₄H₁₈N₂O₂ Pyrimidine, 4-methyl-6-(*N*-methyl-anilino)-2-phenyl-, picrate, 97⁸.
- C₂₄H₁₈O₂ Benzohydrol, α -phenylethynyl-, propionate, 1980¹.
- Δ^2 -1,4-Butenedione, 3,4-diphenyl-1-(3,4-xylyl)-, 3048².
- C₂₄H₁₈O₂ 1,2-Pyran-2-ol, 2-(2,4-cresyl)-4,6-diphenyl-, 410⁸.
- C₂₄H₁₈O₂ Δ^2 -1,4-Butenedione, 1-(3,4-dimethoxyphenyl)-3,4-diphenyl-, 3048².
- 1,2-Pyran-2-ol, 6-(2,4-cresyl)-4-phenyl-6-salicyl-, 410⁸.
- C₂₄H₁₈O₂Zr Compd. from ZrCl₄ and PhOH, 1069⁴.
- C₂₄H₁₈O₁₁ Isorhamnetin, tetraacetate, 93⁴.
- C₂₄H₁₈Pb Plumbane, tetraphenyl-, 678², 3855⁸.
- C₂₄H₁₈Si Silicane, tetraphenyl-, 678².
- C₂₄H₁₈Sn Stannane, tetraphenyl-, 678².
- C₂₄H₁₈AsO₁₁ Gallic acid, Me ester, arsenate, 1105¹.
- C₂₄H₁₈BiCl₃ Bismuthine, tris(carboxyphenyl)-, tri-Me ester, dichloride, 2466⁷, ⁸.
- C₂₄H₁₈ClO₂Zr Compd. from ZrCl₄ and methyl salicylate, 1069⁴.
- C₂₄H₁₈ClO₁₁ 2-(2,4-Dihydroxystyryl)-7-hydroxy-3-methylbenzopyrylium perchlorate, triacetate, 408⁸.
- C₂₄H₁₈N 2-Naphthylamine, *N*, *N*-dibenzyl-, 1797¹.
- C₂₄H₁₈NO₂ Butyronitrile, γ -anisoyl- α , β -diphenyl-, 1651⁴.
- 2(1)-Pyridone, 6-*p*-anisyl-3,4-dihydro- α , β -diphenyl-, 1651⁴.
- C₂₄H₁₈NO₂S Naphthalenesulfonamide, *N*-(β -hydroxy- β , β -diphenylethyl)-, 568².
- C₂₄H₁₈NO₂ Anthranilic acid, *N*-benzoyl-*N*- β -hydroxyethyl-, Me ester, benzoate, 2467⁸.
- Benzoic acid, *p*-*N*- β -hydroxyethylbenz-amido-, Me ester, benzoate, 2467⁸.
- Propionic acid, β -benzoyl- β -hydroxy- α -phenyl-, Me ester, oxime, benzoate, 583⁷.
- C₂₄H₁₈NO₂S 2-Benzisulfonazolol, 1-benzoyl-1,2-dihydro-2-propyl-, benzoate, 3202⁸.
- C₂₄H₁₈NO₁₁ Benzyl alcohol, 3,4,5-trihydroxy-, tris(methyl carbonate), naphthylurethan, 2886⁸.
- C₂₄H₁₈N₂O Guanidine, β -*o*-anisyl- α -1-naphthyl- γ -phenyl-, -H₂SO₄, 1463⁸.
- C₂₄H₁₈N₂O₂ Phloroglucinol, 2,4,6-tris(*p*-hydroxy-anilino)-, 2676².
- C₂₄H₁₈ Anthracene, 9-butyl-10-phenyl-, 3191⁴.
- C₂₄H₁₈BrN₂O₂ 2,6-*p*-Cymenediamine, *N*, *N'*-di-benzoyl-3,5-dibromo-, 903².
- C₂₄H₁₈CuO₄ Δ^2 -1,3-Pentenedione, 5-methoxy-1-phenyl-, 2901².
- C₂₄H₁₈N₂O Quinoxaline, 1,4-dibenzoyl-1,2,3,4-tetrahydro 2,3-dimethyl-, 1653⁴.
- C₂₄H₁₈N₂O₂ Glyoxylic acid, (4,6-dimethyl-*o*-anisyl)-, benzoylphenylhydrazone, 1110⁸.
- Quinoxaline, 2,3-bis(3,4-dimethoxyphenyl)-, 1975¹.
- C₂₄H₁₈N₂ Benzidine, *N*, *N'*-bis(*o*-aminophenyl)-, and *di-HCl*, 913².
- Pyrrolo[3,4- β]quinoxaline, 1,3-dihydro-1-methyl-1-(*N*-methylanilino)-3-phenyl-, 1106⁷.
- C₂₄H₁₈N₂O Phthalic acid, acetylphenylhydrazide, 1329¹.
- C₂₄H₁₈N₂O₂ 7-Benzoyloxy-3,4-dihydro-6-methoxy-2-methylisoquinolinium picrate, 90⁸.
- C₂₄H₁₈NO₁₅S₂ Benzenesulfonic acid, *m*-nitro-, benzidine salt, 1103⁸.
- C₂₄H₁₈N₂O₂ 2-Formyl-1,3,3-trimethylindolinium picrate, phenylhydrazide, 407⁷.
- C₂₄H₁₈O₂ Binaphthyl, diethoxy-, 2472².
- Phthalide, 2,2-di-2,4-(and 2,5)-xylyl-, 579².
- C₂₄H₁₈O₂ 1,2-Benzopyran, 2,2-di-*p*-anisyl-4-methoxy-, 3613⁸.
- Butyric acid, γ -anisoyl- α , β -diphenyl-, 1651⁴.
- C₂₄H₁₈BrN₂O₂ 2,6-*p*-Cymenediamine, *N*, *N'*-dibenzoyl-3-bromo-, 903².
- C₂₄H₁₈ClO₄ Δ^2 -Cyclohexenecarboxylic acid, 6-*o*-anisyl-4-(*p*-chlorostyryl)-2-keto-, Et ester, 2259¹.
- C₂₄H₁₈NO₂ Benzamide, *N*-[γ -(*p*-hydroxyphenyl)-*sec*-butyl]-, benzoate, 1449⁷.
- Butyramide, γ -anisoyl- α , β -diphenyl-, 1651⁴.

- C₁₂H₁₁NO₇** 1,2-Benzacridine-7-carboxylic acid, 5,6-dihydro-, glucoside, 1122⁹.
- C₁₁H₁₂N₂O** 6 - Phenhomazine - *N'* - anthranilaldehyde, 5,6-dihydro-*N'*-propyl-, 1641⁸.
- C₁₁H₁₂BrClN₂O₂** Pyruvic acid, bromochloro-, strychnine salt, 3600⁶.
- C₁₁H₁₂N₂O** Diimide, α -trimethylacetyl- β -triphenylmethyl-, 1455⁴.
- C₁₂H₁₂N₂O₂** Acetamide, α -benzamido-*N*-(β -hydroxy- β , β -diphenylisopropyl)-, 568^{4,7}.
- Benzoic acid, *p*-(α -*p*-phenetyliminobenzylamino)-, Et ester, and -HCl, 236^{4,8}.
- C₁₂H₁₂N₂O** 3(2)-Pyrrolone, 4-hydroxy-2-methyl-2 - (*N* - methylanilino) - 5 - phenyl-, phenylhydrazone, 1106⁷.
- C₁₂H₁₂N₂O₂** 1,4-Quinoxalinedicarboxanilide, 2,3-dihydro-2,3-dimethyl-, 1653⁷.
- C₁₂H₁₂N₂O₄** Piperazine, 1,4-bis(β -phthalimidoethyl)-, di HBr, 566⁸.
- C₁₂H₁₂N₂O₂** *perri*-Indolocarbazole, 1,2,3,4,4b,5,6,7,7a,12b-decahydro-, picrate, 3190⁴.
- C₁₂H₁₂N₂O₁₁S₂** 2-Naphtholdisulfonic acid, 5-nitro-*o* toluidine salt, 1646⁸.
- C₁₂H₁₂O₂** 1-Indanol, 3-methoxy-2,2-dimethyl-1,3-diphenyl- 3614⁴.
- Toluic acid, α , α -di-2,4 (and 2,5)-xylyl-, 579⁷.
- C₁₂H₁₂NO** Propiophenone, β -anilino- β -phenyl-4-propyl-, 308².
- C₁₂H₁₂NO₂** Benzamide, *N*-(β hydroxy α -methyl- γ , γ' -diphenylisobutyl)-, 568².
- C₁₂H₁₂NO₂** See *Peronine*.
- C₁₂H₁₂NO₂** Apoptropine, *N*-oxide, salicylate, 384⁴.
- C₁₂H₁₂N₂O₂** Hydrocinnamanilide, α -(β -phenylalanyl amino)-, 378².
- C₁₂H₁₂N₂O₁₀** Codeinone, dihydro-, isoxime, picrate, 2697⁹.
- C₁₂H₁₂NO** Benzamide, *N*-[*p*-(phenethylamino-methyl)phenethyl]-, 560⁷.
- Benzanilide, *p'*-(benzylbutylamino)-, 2884⁵.
- Pivalic acid, triphenylmethylhydrazide, 1455⁴.
- C₁₂H₁₂N₂O₂S₂** 2 Naphthodisulfonic acid, toluidine salt, 1646⁸.
- C₁₂H₁₂N₂O₂S₂** 2-Naphtholdisulfonic acid, *p*-anisidine, salt, 1646⁸.
- C₁₂H₁₂N₂O₂** Dimethyldiphenethylammonium picrate, 2660⁴.
- perri*-Indolocarbazole, 1,2,3,4,4a,4b,5,6,7,7a,12a,12b-dodecahydro-, picrate, 3190⁴.
- C₁₂H₁₂O₂** Δ^2 -Cyclohexenone, 5 (3,4-dimethoxyphenyl)-3-(3,4-dimethoxystyryl)-, 3611⁹.
- C₁₂H₁₂O₂** Carbinol, anisylbisdimethoxyphenyl-, 1982^{4,7}.
- C₁₂H₁₇Bi** Bismuthine, trixylyl-, 2466⁸.
- C₁₂H₁₇BiCl** Bismuthine, trixylyl-, dichloride, 2466⁸.
- C₁₂H₁₇ClN₂O₂** 1,2-Ethanediol, 1,1-bis(*p*-dimethylaminophenyl)-2-phenyl-, monoperchlorate, 1110⁹.
- C₁₂H₁₇ClO₁₂** 7-Glucosidoxy-3,3',4' trimethoxy flavylum chloride, 1268².
- C₁₂H₁₇NO₂S** Toluenesulfonamide, *N*-(β -hydroxy- α -methyl- γ , γ' -diphenylisobutyl)-, 568³.
- C₁₂H₁₇NO₁₁** Indican, pentaacetate, 3602⁴.
- C₁₂H₁₇NO₁₁** 2-Indolecarboxylic acid, 3 tetraacetyl- β -glucosidoxy-, Me ester, 3602⁵.
- C₁₂H₁₂N₂Sn** 3471⁴.
- C₁₂H₁₂N₂O** Ethanol, 1,1-bis(*p*-dimethylamino)-2-phenyl-, 1110⁷.
- C₁₂H₁₂N₂O₂** 1,2-Ethanediol, 1,1-bis(*p*-dimethylaminophenyl)-2-phenyl-, 1110⁹.
- C₁₂H₁₂N₂O₂** Leucine, *N* - (α - benzamidocinamyl)-, Et ester, 1813⁸.
- 3-Pyrrolecarboxylic acid, 5,5'-(methylbenzal) bis[2-methyl-, di-Et ester, 381^{4,8}.
- C₁₂H₁₂N₂O₁₀** 2,3-Butanediamine, dipicrolonate, 2120¹.
- C₁₂H₁₂O₆** Δ^2 -2 Butenone, 4-(3,4-dimethoxyphenyl)-, dimer, 3612¹.
- C₁₂H₁₂O₁₂** Coniferylaldehyde, tetraacetylgluco-, 2475⁸.
- C₁₂H₁₂BrNO₂S** Benzylhydroxymethylphenylammonium bromocamphorsulfonate, 65⁹.
- C₁₂H₁₂BrN₂** 1,4-Bis(1,2,3,4-tetrahydro-2-naphthyl)-4-piperazinium dibromide, 567⁴.
- C₁₂H₁₂N₂O₂** Pseudobrucidine, methyl-, and di-HI, 3367^{8,9}.
- C₁₂H₁₂N₂O₂** Akumaine, Ac deriv., and salts, 3623⁴.
- C₁₂H₁₂N₂O₄** Ethane, *s*-bis[3-nitro-4 (1-piperidyl) phenyl] (?), 2681².
- C₁₂H₁₂O₂** 3-Decanone, 1-(4-hydroxy-*m*-ani-yl)-, benzoate, 1975⁷, 3623⁷.
- Shogaol, dihydro-, benzoate, 1975⁷.
- C₁₂H₁₂O₂** Anisaldehyde, compd. with dimethyl-1,3-cyclohexanedione, 2253¹.
- C₁₂H₁₂O₁₂** Coniferin, tetraacetate, 2475⁸.
- Glucosheptoside, pentaacetyl- β benzyl α -, 2252².
- C₁₂H₁₂ClN₂O₂** Methylneobrucidinium chloride, 3367⁸.
- C₁₂H₁₂IN₂O₂** Brucidine, methiodide, 3366⁹.
- Methylneobrucidinium iodide, 3367⁸.
- C₁₂H₁₂NO₄** Des-*N*-methylcorybulbine, ethyl ether, 2903⁹.
- C₁₂H₁₂NO₂S** Ethanol, 2-amino 1,2-diphenyl-, camphorsulfonate, 2254².
- C₁₂H₁₂N₂O₂** Brucidone, semicarbazone, 3367⁸.
- C₁₂H₁₂N₂O₂** 2,5-Piperazinedione, 1,4-dimethyl-, addn. compd. with *p*-phenylazoaniline, 68⁹.
- C₁₂H₁₂O₂PS** Benzylhydroxymethylphenylphosphonium camphorsulfonate, 664^{4,8}.
- C₁₂H₁₂AuCl₂NO₂** Isocorybulbine, ethoxy-, methochloroaurate, 1963⁹.
- C₁₂H₁₂Al₂Cl₂N₂** Spiro[isquinoline - 2(1),1' - bistrimethylenediamine - 5',2''(1'') - isokinoline], 3,4,3'',4'' - tetrahydro-*N*, *N'*-dihydroxy-, bischloroaurate, 1653⁹.
- C₁₂H₁₂Br₂Cl₂N₂** Addn. compd. of phenylhydrazine and BeCl₂, 1601⁹.
- C₁₂H₁₂Br₂N₂** Spiro[isquinoline - 2(1),1' - bistrimethylenediamine - 5',2''(1'') - isoquinoline], 3,4,3'',4'' - tetrahydro-*N*, *N'*-dihydroxy-, dibromide, 1653¹.
- C₁₂H₁₂ClNO₂** Dibenzoquinoline, 3-ethoxy-5,6,13,13a - tetrahydro - 2,9,10 - trimethoxy-13-methyl-, methochloride, 2903⁹.
- C₁₂H₁₂Cl₂N₂** Spiro[isquinoline - 2(1),1' - bistrimethylenediamine - 5',2''(1'') - isoquinoline], 3,4,3'',4''-tetrahydro-*N*, *N'*-dihydroxy-, dichloride, 1653⁹.
- C₁₂H₁₂Cl₂N₂Pt** Spiro[isquinoline - 2(1),1' - bistrimethylenediamine - 5',2''(1'') - isoquinoline], 3,4,3'',4'' - tetrahydro-*N*, *N'*-dihydroxy-, chloroplatinate, 1653⁹.
- C₁₂H₁₂INO₂** Des-*N*-methylcorydaline, methiodide, 1963⁷.
- Dibenzoquinolizine, 3-ethoxy-5,6,13,13a-tetrahydro - 2,9,10 - trimethoxy - 13-methyl-, methiodide, 2903⁹.
- C₁₂H₁₂N₂O** Benzamide, *N*-[η -(1,2,3,4-tetrahydro-2-naphthylamino)heptyl]-, 566⁷.
- C₁₂H₁₂N₂O₂** *p*, *p'*-Bicaproanilide, 2884⁴.

- 2,7-Octanedione, 4,5-bis(*p*-dimethylamino-phenyl)-, 1107⁸.
 Strychnidine, ethoxymethylidihydro-, 3366⁴.
 C₂₄H₃₂N₂O₃ Pseudobrucidine, dihydromethyl-, 3367⁹.
 C₂₄H₃₂N₂O₄ Brucidine, methohydroxide, 3367¹.
 C₂₄H₃₂N₂O₃ Arabinose, *d*-galacto-*d*-, benzyl-phenylhydrazones, 393².
 C₂₄H₃₂N₄ 2-Tetrazene, *s*-dicyclohexyldiphenyl-, 1102².
 C₂₄H₃₂N₂O₃ Galactose, 6-glucosido-, osazone, 1635⁵.
d-Glucose, 6-*β*-*d*-galactosido-, osazone, 1794⁷.
 Melibiose, osazone, 2665⁹.
 C₂₄H₃₂O₃ Bilisoidanic acid, 3903³.
 Tribasic acid from bilisoidanic acid, 3903³.
 C₂₄H₃₂N₂O₁₀ Inulin, hexaacetate, 2881⁸.
 C₂₄H₃₂O₁₆ Biosan, hexacetyl-, 174².
 Dihexosan, hexacetyl-, 1472⁶.
 C₂₄H₃₂AlO₈ 1,3-Cyclohexanedione, 5,5-dimethyl-, Al complex salt, 394³.
 C₂₄H₃₂FO₁₆ 4-Glucosidomannose, hexaacetyl-fluoro-, 357².
 C₂₄H₃₂IN₂O₂ Strychnidine, dihydromethoxymethyl-, methiodide, 3365⁵.
 C₂₄H₃₂IN₂O₂ Dihydromethylnobrucidinium iodide, 3367⁸.
 C₂₄H₃₂IN₂O₂ Brucine, tetrahydro-, methiodide, 3367¹.
 5,5'-Spirobi-*m*-dioxane, 2,2'-bis(*p*-dimethylamino-phenyl)-, methiodide, 895⁷.
 C₂₄H₃₂NO₁₆ Des-*N*-dimethylcorydaline, dihydro-, and salts, 1963³.
 C₂₄H₃₂N₂O₂ Urea, α -[β -(hydroxymethyl)- α -methyl- β -propylamyl]- β -phenyl-, carbamate, 3347⁴.
 C₂₄H₃₂N₂O₂ See *Eucupine*.
 C₂₄H₃₂N₂O₃ Strychnidine, dihydromethoxymethyl-, methohydroxide, 3365⁵.
 C₂₄H₃₂N₂O₁₄ Piperazine, 1,4-bis(δ -aminobutyl)-, dipicrate, 566⁹.
 C₂₄H₃₂O₄ Dehydrocholic acid, 772¹.
 C₂₄H₃₂O₇ Biliobanic acid, 1992³.
 C₂₄H₃₂O₁₀ Cilicnic acid, 1991⁶.
 Isocilicnic acid, 1992⁴.
 C₂₄H₃₂O₁₃ Ciloidanic acid, 1991⁷, 2905⁴.
 C₂₄H₃₂ClN₂O₂ Strychnidine, tetrahydromethoxymethyl-, methochloride, 3366⁴.
 C₂₄H₃₂IN₂O₂ Strychnidine, tetrahydromethoxymethyl-, methiodide, 3366⁵.
 C₂₄H₃₂NO₄ Des-*N*-dimethylcorydaline, tetrahydro-, 1963³.
 C₂₄H₃₂BIIN₂ Dimethylanilinium hexaiodobismuthite, 2855⁶.
 C₂₄H₃₂BrNO Chaulmoogranilide, *p*-bromo-, 1449¹.
 C₂₄H₃₂N₂O₇ Tricyclohexylamine, picrate, 1799⁹.
 C₂₄H₃₂O₂ Chaulmoogric acid, Ph ester, 572¹.
 C₂₄H₃₂O₄ Dehydrodesoxycholic acid, 1991³.
 C₂₄H₃₂O₅ Ciloxanic acid, di-Me ester, 2702⁴.
 C₂₄H₃₂O₇ Reductoisobiliobanic acid, 101⁷.
 C₂₄H₃₂O₁₀ Choloidanic acid, 1992³, 2905⁴.
 C₂₄H₃₂Fe₂N₂O₁₂P₂ + H₂O, 2232².
 C₂₄H₃₂NO Chaulmoogranilide, 1449¹.
 C₂₄H₃₂N₂O₃ Ciloxanic acid, di-Me ester, dioxime, 2702⁴; Et ester, dioxime, 2702⁴.
 Stearic acid (dinitrophenyl)-, 1642³.
 C₂₄H₃₂O₂ Elaidic acid, Ph ester, 2126⁷.
 Oleic acid, Ph ester, 2126³.
 C₂₄H₃₂O₂ Cholic acid, 7-keto-, 1991³.
 C₂₄H₃₂O₄ Apocholeic acid, 1312³.
 Cholic acid, hydroxyketo-, 1991³.
 C₂₄H₃₂O₄ Oxidation product of rubber, 1991³.
 C₂₄H₃₂O₇ Hydroxytricarboxylic acid, m. 255-6° from chenodesoxybiliobanic acid, 101⁴.
 C₂₄H₃₂O₁₂ Disulfide, di(diacetoneglucosyl), 1634⁴.
 C₂₄H₃₂Cl₂NO Stearanyl, α , α' -dichloro-, 2875⁶.
 C₂₄H₃₂NO₂ Cholic acid, 7-keto-, oxime, 1991³.
 C₂₄H₃₂NO₂ Aminotetracarboxylic acid from desoxybiliaric acid, 2477¹.
 C₂₄H₃₂NO₂ See *Conessine*.
 C₂₄H₃₂N₂O₃ Pelargonamide, *N*, *N'*-*p*-phenylenebis-, 2884⁶.
 C₂₄H₃₂O Ketone, bisnorcholyl methyl-, 591⁴.
 C₂₄H₃₂O₂ Bismorcholanic acid, Et ester, 591⁴.
 Cholic acid, 248³, 590⁶.
 Norcholanic acid, Me ester, 590⁶.
 Stearic acid, phenyl-, 1642².
 C₂₄H₃₂O₂ Platanolic acid, 599⁶.
 C₂₄H₃₂O₂ Chenodesoxycholic acid, 101³, 952².
 Cholic acid, 7,12-dihydroxy-, 101³.
 Desoxychiloxanic acid, di-Me ester, 2702⁴.
 C₂₄H₃₂O₂ (See also *Cholic* acid.)
 Cholic acid, 3,7,12-trihydroxy-, 101³.
 C₂₄H₃₂O₂ Tetraglucosan, 1849⁴.
 C₂₄H₃₂NO₂ Stearamide, phenyl-, 1642².
 C₂₄H₃₂ Choline, 591⁴.
 C₂₄H₃₂BrN₂O₄ Piperazine, 1,4-bis[*N*-(α -bromopropionyl)leucyl]-2,5-dimethyl-, 384¹.
 C₂₄H₃₂O Alcohol from mistletoe berries, 800⁶.
 C₂₄H₃₂O₂ Alcohol from bark, 600¹.
 C₂₄H₃₂O₁₁ Stachyose, 1077⁴.
 C₂₄H₃₂O₂ Heptytrin, 1478⁹.
 C₂₄H₃₂FeN₂Pb₂ Triethyllead ferricyanide, 1445⁴.
 C₂₄H₃₂N₂O₂ Piperazine, 1,4-bis(*N*-alanylleucyl)-2,5-dimethyl-, and di-*II*Br, 384¹.
 C₂₄H₃₂O₂ Isoeric acid, Et ester, 1629⁹.
 Nervonic acid, 54⁶, 2458⁶.
 C₂₄H₃₂O₂ Acid, m. 65°, from cerebrosides of brain, 54⁷.
 C₂₄H₃₂O₄S₂ Lauric acid, α , α' -dithiobis-, 3045⁹.
 C₂₄H₃₂Au₂Cl₂S₂, 3495⁹.
 C₂₄H₃₂N₂O₁₂P₂ β -Ovotyrin, 2476⁷.
 C₂₄H₃₂O₂ Arachidic acid, Bu ester, P 593⁹.
 Lignoceric acid, 2458⁷.
 C₂₄H₃₂O₂S₂ Maltose, bis(di-Pr mercaptal), 64⁴.
 Sucrose, bis(di-Pr mercaptal), 64⁴.
 C₂₄H₃₂Cr₂N₂O₁₂ + 2H₂O, 1601².
 C₂₄H₃₂N₂ Piperazine, 1,4-bis[ϵ -(ϵ -aminoamyl)-amino]amyl-, 566⁹.
 C₂₄H₃₂N₂O₂ Indigo yellow 3 G ciba, Ac deriv., 901.
 C₂₄H₃₂Br₂N₂O₂ Compd. from 5,7,5',7'-tetrabromindogotin and AcCl, 88².
 C₂₄H₃₂NO₂ Catechol- β -phenylpyridinedicarboxylein, 382⁴.
 Resorcinol - β - phenylpyridinedicarboxylein, 382⁴.
 C₂₄H₃₂NO₂ Hydroxyquinol- β -phenylpyridinedicarboxylein, 382⁴.
 Phloroglucinol - β - phenylpyridinedicarboxylein, 382⁴.
 C₂₄H₃₂Br₂O₂ Pyrogallolbenzein, dibromo-, triacetate, 1982⁹.
 C₂₄H₃₂Br₂N₂O₂ Indigotin, 1-benzoyl-5,7,5',7'-tetrabromo-, EtOH addn. compd., 89².
 C₂₄H₃₂N₂O₂ Phthalimide, *N*-(7-benzalamino-2-naphthyl)-, 2892¹.
 C₂₄H₃₂O₂ 3,3'-Spirobi[β -naphthopyran], 408¹, 1267⁸.
 C₂₄H₃₂ClO₂ 3-[β -(2-Hydroxy-1-naphthyl)vinyl]- β -naphthopyrylium chloride, 1267⁷; and -HCl, 408¹.
 C₂₄H₃₂ClO₂TC Phenoxtellurine, 2-chloro-8-

- methyl-?), phenoxtellurine addn. compd., 1251¹.
- C₂₁H₁₇NO₄** Phenol-*β*-phenylpyridinedicarboxylein, 382⁴.
- C₂₁H₁₇N₂O** 2-Naphthol, 1-(2-phenyl-3-quinolyl-azo)-, 247⁴.
- C₂₀H₁₅BrNO₃S** Quinaldine, 3-(*p*-bromophenylsulfonyl) - 8 - methoxy - α - piperonylidene-, 412¹.
- C₂₀H₁₅ClNO₃S** Quinaldine, 3-(*p*-chlorophenylsulfonyl) - 8 - methoxy - α - piperonylidene-, 412¹.
- C₂₀H₁₅N₂O₂** Indigotin, 1-benzoyl-7,7'-dimethyl-, 88⁴.
- 3,7-*peri*-Naphthoquinoline-1-*N'*-authranilic acid, 7-keto-*N'*-methyl-, Me ester, 90¹.
- C₂₀H₁₅N₂O₂** Cinchophen, 6-(*p*-acetamidophenyl)-3',4'-methylenedioxy-, 247³.
- C₂₀H₁₅N₂O₂** Cinchophen, 3-*p*-carboxybenzamido-4'-methoxy-, 247⁴.
- C₂₀H₁₅N₂O₂** *m*-Phenylenediamine- β -phenylpyridinedicarboxylein, 382⁴.
- C₂₀H₁₅N₂O₂** 2,1,3-Benzotriazol-5-ol, 4,4'-methylenebis[2-phenyl-, 2689³.
- C₂₀H₁₅O** $\Delta^1,4$ -3-Pentadienone, 1,5-di-2-naphthyl-, 87¹.
- C₂₀H₁₅O₂** 1,4-Naphthoquinone, 2-benzohydryl-3-hydroxy-, acetate, 241¹.
- C₂₀H₁₅O₃** 2(1)-Benzofuranone, 5,6-dihydroxy-1-(2-hydroxy - 1 - naphthylmethylene)-, triacetate, 1984⁴.
- Pyrogallolbenzein, triacetate, 1982⁴.
- C₂₀H₁₅BrN** Cinnamaldehyde, [4-(*o*-bromophenylazo)-1-naphthyl]hydrazone, 1114².
- C₂₀H₁₅Cl** Methane, chlorobis(*p*-phenylphenyl)-, 578⁷.
- C₂₀H₁₅ClN** Cinnamaldehyde, [4-(*o*-chlorophenylazo)-1-naphthyl]hydrazone, 1114¹.
- C₂₀H₁₅N** α -Naphthazole, 2-benzyl-3-phenyl-, 1263¹.
- C₂₀H₁₅NO₃S** Quinaldine, 8-methoxy-3-(phenylsulfonyl)- α -piperonylidene-, 411¹.
- C₂₀H₁₅** Methane, tetraphenyl-, 678⁷, 3360².
- C₂₀H₁₅N** Acridan, 3-amino-5,5-diphenyl-, 232⁹.
- C₂₀H₁₅N₂O** Urea, *s*-di-3-acenaphthenyl-, 910⁴.
- C₂₀H₁₅N₂O₂** Cinchophen, 6-(*p*-acetamidophenyl)-4'-methoxy-, 247³.
- C₂₀H₁₅N₂O₂** Cinchophen, 6-(*p*-acetamidophenyl)-4'-hydroxy-3'-methoxy-, 247³.
- C₂₀H₁₅O** Benzohydrol, *p*, *p'*-diphenyl-, 578³.
- p*-Cresol, α -triphenyl-, 2470⁴.
- Ether, phenyl triphenylmethyl-, 2470⁴.
- Phenol, *p*-triphenylmethyl-, 3360².
- C₂₀H₁₅O₂** 2-*o*-Quinopyran, 6-*p*-anisyl-4'-methoxy-4-phenyl-, 410⁴.
- C₂₀H₁₅O₃** 3-Indenecarboxylic acid, 2,2'-methylenebis[1-keto-, di-Et ester, 3900⁴.
- C₂₀H₁₅O₃** Coumarin, 5,7-dihydroxy-4-(3,4,5-trihydroxyphenyl)-, pentaacetate, 1981⁴.
- C₂₀H₁₅OIO₃** 2-*p*-Anisyl-6-(2,4-cresyl)-4-phenylpyrylium chloride, and -HCl, 410⁴.
- C₂₀H₁₅OIO₃** 2-(4-Methyl-*o*-anisyl)-4,6-diphenylpyrylium perchlorate, 410⁴.
- C₂₀H₁₅OIO₃** 2-*p*-Anisyl-6-(2,4-cresyl)-4-phenylpyrylium perchlorate, 410⁴.
- C₂₀H₁₅OIO₃** 2-(and 4)-*p*-Anisyl-6-(and 2)-(2-hydroxy-*p*-anisyl)-4-(and 6)-phenylpyrylium perchlorate, 410⁴.
- C₂₀H₁₅N** Aniline, *N*-triphenylmethyl-, 3359².
- C₂₀H₁₅NO** 3-Pyridineethanol, α -methyl- α -(β -1-naphthylstyryl)-, 909⁴.
- C₂₀H₁₅NO** Cinchophen, 3-(γ -phenylpropyl)-, 1123⁴.
- Pyridine, 2-*p*-anisyl-6-(2,4-cresyl)-4-phenyl-, 410⁴.
- C₂₀H₁₅NO** Pyridine, 2-(and 4)-*p*-anisyl-6-(and 2)-(2-hydroxy-*p*-anisyl)-4-(and 6)-phenyl-, 410⁴.
- C₂₀H₁₅NO₃S** Quinaldine, α -benzal-8-methoxy-3-*p*-tolylsulfonyl-, 411¹.
- C₂₀H₁₅NO₃S** Quinaldine, 3-(*o*-anisylsulfonyl)- α -benzal-8-methoxy-, 412¹.
- C₂₀H₁₅N₂** Acridan, diamino-5,5-diphenyl-, 232⁹, 2268⁴.
- C₂₀H₁₅N₂O** 4-Pyrazolocarboxanilide, 3(or 5)-methyl-1-phenyl-5(or 3)-styryl-, 734³.
- C₂₀H₁₅N₂O** Indole, 2,2'-*m*-nitrobenzylbis[3-methyl-, 1118⁴.
- C₂₀H₁₅O₂P** Methanephosphonic acid, (*m*-hydroxyphenyl)diphenyl-, benzoate, and di-Ag salt, 67¹.
- C₂₀H₁₅Ge** Germane, triphenyl-*p*-tolyl-, 3897¹.
- C₂₀H₁₅GeO** Germane, *p*-anisyltriphenyl-, 3897¹.
- C₂₀H₁₅N₂** 2-Propanone, 1,3-diphenyl, naphthylhydrazone, 1263¹.
- C₂₀H₁₅N₂O** Carbanilide, *p*, *p'*-bis(*p*-aminophenyl)-, sulfate, 80⁴.
- C₂₀H₁₅O₂** Benzohydrol, α -phenylethiunyl-, butyrate, 1980⁴.
- C₂₀H₁₅O₂** 1,2-Pyran-2-ol, 6-*p*-anisyl-2-(2,4-cresyl)-4-phenyl-, 410⁴.
- C₂₀H₁₅O₂** 1,2-Pyran-2-ol, 6-*p*-anisyl-2-(2-hydroxy-*p*-anisyl)-4-phenyl-, 410⁴.
- C₂₀H₁₅O₂** *o*-Toluic acid, α , α -bis(*p*-hydroxyphenyl)-, Me ester, diacetate, 404².
- C₂₀H₁₅N₂O₂** Benzoic acid, *p*-[4-methyl-3-(4-methyl-3-nitrobenzamido)benzamido]-, Et ester, 1451⁴.
- C₂₀H₁₅** Anthracene, 9-isomayl-10-phenyl-, 3191³.
- C₂₀H₁₅N₂O₂** Glyoxylic acid, (4,6-dimethyl-*o*-anisyl)-, Me ester, benzoylphenylhydrazone, 1116².
- C₂₀H₁₅O₂** Butyric acid, γ -anisoyl- α , β -diphenyl-, Me ester, 1651⁴.
- o*-Cresol, 4,4'-benzalbis-, diacetate, 1645⁴.
- C₂₀H₁₅O₂** *o*-Cresolbenzein, hydrate, diacetate, 1645².
- C₂₀H₁₅O₂** Pimelic acid, β , δ -dibenzoyl- α , ϵ -diketo-, di-Et ester, 3900⁴.
- C₂₀H₁₅O₂** Cinnamic acid, α ,3-diacyetyl-3-carboxy- β , δ -dihydro - 6 - hydroxy - 2 - keto-, di-Et ester, benzoate, 1266.
- C₂₀H₁₅O₁₀** $\Delta^2(4)$ - α -Furanacetic acid, α ,4-bis(3,4-dimethoxyphenyl) - 3 - hydroxy - 5 - keto-, Me ester, acetate, 1110⁴.
- C₂₀H₁₅IN₂** Pinacyanol, 32014⁴.
- C₂₀H₁₅NO** Benzamide, *N*-[γ -(hydroxyanisyl)-*sec*-butyl]-, benzoate, 1449⁴.
- C₂₀H₁₅NO** Pimelic acid, β , δ -dibenzoyl- α , ϵ -diketo-, di-Et ester, oxime, 3900⁴.
- C₂₀H₁₅N₂O₂** Benzoic acid, *p*-[3-(3-amino-4-methylbenzamido)-4-methylbenzamido]-, Et ester, 1451⁴.
- C₂₀H₁₅N₂O₂** Malonamide, diethylidialcyl-, diacetate, 1866².
- C₂₀H₁₅N₂O₂** Hydrocinnamic acid, α , β -bis(*p*-methylanilinophenylimino)-, *N*, *N'*-dioxide, Et ester, 376⁴.
- C₂₀H₁₅N₂O₂** *peri*-Indolocarbazole, 1,2,3,4,4b,5-, 6,7,7a,12b-decahydro-9-methyl-, picrate, 3199⁴.
- C₂₀H₁₅O₂** Benzoate of compd. from di-Et xanthophanate, 1266².
- C₂₀H₁₅Cl₂MnN₂O₂** + 2H₂O, 2232¹.
- C₂₀H₁₅ClN₂O₂** Brucine, trichloroacetate, 3905⁴.
- C₂₀H₁₅N** Piperidine, 1-(3,5-di-*p*-tolylphenyl)-, 1814¹.

- C₂₅H₂₇NO₂ Benzamide, *N*-[α -(α -hydroxybenzohydryl)isomethyl]-, 567⁴.
- C₂₅H₂₇N₃O₇ 2-Naphthylamine, *N*-[p -(β -aminoethyl)benzyl]-, picrate, 566⁷.
- C₂₅H₂₇N₃O₁₀ Codeinone, dihydro-, isoxime, Me ether, picrate, 2698¹.
- C₂₅H₂₇ClIN₂O₅ Acetic acid, chloriodo-, brucine salt, 1963⁹.
- C₂₅H₂₇N₃O Hydrocinnamamide, *N*-phenethyl- α -phenethylamino-, -HCl, 1658².
- C₂₅H₂₇N₃O Hydrocinnamic acid, β -(α -formylisopropyl)-, phenylhydrazide, phenylhydrazone, 3044².
- C₂₅H₂₇N₃O₁₄ Cadaverine, *N*-phenethyl-, dipicrate, 566⁷.
- C₂₅H₂₇O₇ Carbinol, phenylbis(2,4,6-trimethoxyphenyl)-, 1982⁷.
- C₂₅H₂₇N₃O₂ Camphor, 3-[(β -hydroxy- α , β -diphenylethylamino)phenylene]-, 2254².
- C₂₅H₂₇N₃O₂ Porphyrone, phenylhydrazone, 589².
- C₂₅H₂₇N₃O₅ Δ^2 -Cyclohexenone, 5-(3,4-dimethoxyphenyl) - 3 - (3,4 - dimethoxystyryl)-, semicarbazone, 3612¹.
- C₂₅H₂₇ClIN₂ See *Crystal violet*.
- C₂₅H₂₇N₃O₂ Phenolitaconein, *m*-diethylamino-, 3194⁸.
- C₂₅H₂₇N₃O₇ Brucine, methohydrogen carbonate, 3366⁸.
- C₂₅H₂₇N₃O₁₀ Guanidine, α , α' -propylenebis-, dipicronate, 63¹.
- , α , α' -trimethylenebis-, dipicronate, 63¹.
- C₂₅H₂₇O₁₂ Glucoheptoside, pentaacetyl- β -vanillin- α -, 2252¹.
- C₂₅H₂₇NO₁₁S Triacetyl- β -methylglucoside-6-pyridinium toluene-*p*-sulfonate, 63⁷.
- C₂₅H₂₇N₃O (See also *Pyocyanin*.)
Crystal violet, 3514⁹.
- C₂₅H₂₇N₃O₄ 3-Pyrrolicarboxylic acid, 5,5'-(*p*-dimethylaminobenzal)bis[2-methyl-, di-Et ester, 381⁴.
- C₂₅H₂₇N₃O₄ 3-Pyrrolicarboxylic acid, 5,5',5''-methenyltris[2-methyl-, tri Et ester, 381⁴.
- C₂₅H₂₇N₃O₅ Cyclohexylamine, *N*-(γ phenylpropyl)-, picronate, 2882⁵.
- C₂₅H₂₇BrNO₅ Benzylethylhydroxyphenylammonium bromocamporsulfonate, 65⁹.
- Benzylethoxyethyl - *p* - tolylammonium bromocamporsulfonate, 66¹.
- C₂₅H₂₇N₃O Propiophenone, β -phenyl- α , α -di-1-piperidyl-, 3051⁴.
- C₂₅H₂₇N₃O₆ Brucidine, methohydrogen carbonate, 3367¹.
- C₂₅H₂₇N₃O₅ Brucine, methosulfate, 3366⁸.
- C₂₅H₂₇N₃O₈ Acetaldehyde, β -phenylalanyl-amino-, di-Et acetal, picronate, 378².
- C₂₅H₂₇O₄ 3-Hendecanone, 1-(4-hydroxy-m-anisyl)-, benzoate, 3623⁸.
- C₂₅H₂₇IN₂O₃ Pseudobruidine, methyl-, methiodide, 3367⁸.
- C₂₅H₂₇NO₁₄ Arabononitrile, *d*-galactohepta-acetyl-, 393⁴.
- C₂₅H₂₇N₃O₄ 3-Decanone, 1-(4-hydroxy-m-anisyl)-, benzoate, semicarbazone, 3623⁷.
- C₂₅H₂₇N₃O₄ Brucidine, nitromethoxymethylhydro-, 3367⁴.
- C₂₅H₂₇N₃O₇ Ngaiylamine, picronate, 2264¹.
- C₂₅H₂₇IAuCl₂NO₄ Des-*N*-methylisocorybulbine, ethoxy, methochloroaurate, 1963⁹.
- C₂₅H₂₇INO₄ Des-*N*-methylcorybulbine, ethyl ether, methiodide, 2903⁹.
- C₂₅H₂₇N₃O₄ Brucidine, dihydromethoxymethyl-, and di-HI, 3367¹.
- 1,10-Hendecanediol, dicarbanilate, 804¹.
- C₂₅H₂₇N₃O₅ Brucidine, oxymethoxymethylhydro-, 3367².
- C₂₅H₂₇N₃O₇ Brucidine, dioxymethoxymethylhydro-, 3367⁴.
- C₂₅H₂₇N₃O₅ Brucidine, methosulfate, 3366⁸.
- C₂₅H₂₇ClIN₂NaO₄ Hexaethylguanidinium picrate, addn. compd. with Na picrate, 2878⁸.
- C₂₅H₂₇O₁₁ 6- β -Xylosidoglucose, β -heptaacetyl-, 2879⁸.
- C₂₅H₂₇NO₄ Des-*N*-dimethylidihydrocorybulbine, ethyl ether, 2903⁹.
- C₂₅H₂₇N₃O₁₀ Trinitrodicarboxylic acid, *m*. 240⁹, from quillaic acid, 590¹.
- C₂₅H₂₇Cl₂N₃O₂ Strychnidine, dihydromethoxymethyl-, dimethochloride, 3365⁹.
- C₂₅H₂₇Cl₂N₃O₂ Strychnidine, dihydromethoxymethyl-, dimethiodide, 3365⁹.
- C₂₅H₂₇N₃O₂ Brucidine, tetrahydromethoxymethyl-, and salts, 3367⁷.
- C₂₅H₂₇NO₂ Benzoic acid, *o*(and *p*)-chaulmoogramido-, 3900⁸.
- C₂₅H₂₇NO₆ Oxidoanhydrostrophanthidinic acid ethylal, oxime, 99¹.
- C₂₅H₂₇N₃O₇ Ngaiylamine, tetrahydro-, picronate, 2263⁸.
- C₂₅H₂₇Cl₂N₃O₂ Strychnidine, tetrahydromethoxymethyl-, dimethochloride, 3366⁸.
- C₂₅H₂₇Cl₂N₃O₂ Strychnidine, tetrahydromethoxymethyl-, dimethiodide, 3366⁸.
- C₂₅H₂₇O₃ Chaulmoogric acid, tolyl ester, 572¹.
- C₂₅H₂₇O₃ Dehydrodesoxycholic acid, Me ester, 101⁴.
- C₂₅H₂₇ON₂S Mannose, diacetone-, thiocarbonate, 1634⁵.
- C₂₅H₂₇NO Chaulmoogrotoluide, 1449¹.
- C₂₅H₂₇O₂ Oxidation product of rubber, 1901⁸.
- C₂₅H₂₇O₂ Stearic acid, salicylate, 1329¹.
- C₂₅H₂₇O₂ Ketone, methyl norcholyol, 591⁴.
- C₂₅H₂₇O₂ Norcholic acid, Et ester, 590¹.
- Stearic acid, phenyl-, Me ester, 1642¹.
- C₂₅H₂₇O₃ Cholic acid, 7,12-dihydroxy-, Me ester, 101⁴.
- Desoxycholic acid, Me ester, 101⁴.
- C₂₅H₂₇NO Ketone, methyl norcholyol, oxime, 591⁴.
- C₂₅H₂₇ Homocholane, 591⁴.
- C₂₅H₂₇O Bisnorcholyolcarbinol, dimethyl-, 590¹.
- C₂₅H₂₇NO₁₂ α (and β)-Tetraacetylglucosido-1-pyridinium toluene-*p*-sulfonate, 64¹.
- C₂₅H₂₇N₃O₄ Δ^9 , Δ^8 -Bifluorene, 2,2' dinitro-, 1644¹.
- Phthalimide, *N*, *N'*-2,7-naphthylenebis-, 2802¹.
- C₂₅H₂₇N₃O₂ 9-Fluorenone, 2,2'-aziminobis-, 1644¹.
- C₂₅H₂₇N₃O₂ 5(7) α , γ' -Dibenzophenazinone, 12-nitro-7-phenyl-, 1958⁸.
- C₂₅H₂₇N₃O₄ Carbazole, 2,7-dinitroanthraquinone addn. compd., 1116².
- C₂₅H₂₇Br Anthracene, 9,10-bis(*p*-bromophenyl)-, 1115⁴.
- C₂₅H₂₇BrCl Anthracene, 9,10-bis(*p*-bromophenyl) - 9,10 - dichloro - 9,10 - dihydro-, 1115⁴.
- C₂₅H₂₇BrN Compd. from tetra-9-fluorophenylhydrazine and Br, 3052¹.
- C₂₅H₂₇Cl Anthracene, 9,10-bis(*p*-chlorophenyl), 1115⁴.
- , 1,5-dichloro-9,10-diphenyl-, 3191¹.
- C₂₅H₂₇Cl₂N₃O₂ 1-(1,5-Dichloro-9-anthrylmethyl)-pyridinium picrate, 1261¹.
- C₂₅H₂₇Cl₂ Anthracene, 1,5,9,10-tetrachloro-9,10-dihydro-9,10-diphenyl-, 3191¹.

- $C_{22}H_{11}N_7O$ 5-Isodibenzophenoxazine, 5-phenylimino-, 241^{1,2}.
- $C_{22}H_{11}N_7O_2$ 5-Iso- $\gamma\gamma'$ -dibenzophenoxazin-5-one, 9-anilino-, 1124¹.
- $C_{22}H_{11}N_7O_4$ 9,9'-Bifluorene, 2,2' dinitro-, 1644¹.
- $C_{22}H_{11}N_7O_5S$ Benzophenone, 2,2''-thiobis[5-nitro-, 2693¹.
- $C_{22}H_{11}N_7O_5S_2$ Benzophenone, 2,2'' dithiobis[5-nitro-, 2693¹.
- $C_{22}H_{11}N_7O_5S_2$ 2,2'-Tolandisulfonic acid, 4,4'-dinitro-, di-Ph ester, 908⁹.
- $C_{22}H_{11}N_7O_5$ [1,4-Imidazopyridine[$\Delta^3(2)$]]ace-naphthene[8',3'']1,4 -imidazopyridine-, 2,2''(3'')-dione, 8'-hydroxy-, 1265⁴.
- $C_{22}H_{11}N_7Na_2Ni_2O_{12} + 5H_2O$, 3327⁷.
- $C_{22}H_{11}O_4$ Spiro[indan-2, 2'-tetralin-3', 2''-indan]-1,3,1'',3''-tetrone, 3203².
- $C_{22}H_{17}Br$ Anthracene, 2-bromo-9,10-diphenyl-, 1115⁵.
- $C_{22}H_{17}BrNO$ 2-Naphthol, [(bromophenylazo)-1-naphthylazo]-, 380⁷, 1114⁷.
- $C_{22}H_{17}Cl$ Anthracene, chloro-9,10-diphenyl-, 1115⁵, 3191⁷.
- $C_{22}H_{17}ClNO$ 2-Naphthol, [(*m*-chlorophenylazo)-1-naphthylazo]-, 380⁷.
- $C_{22}H_{17}ClN_2O_2$ 5-Amino 12-nitro-7-phenyl- $\alpha\gamma'$ -dibenzophenazonium chloride, 1988⁴.
- $C_{22}H_{17}NO_2$ 7,8-Benzquinoline 2,4-diol, 3-phenyl-, monobenzoate, 1987⁴.
- $C_{22}H_{17}N_3O$ 9-Fluorenone, 2-(2-fluoryltriazeno)-(?), 1644¹.
- 5-Iso- $\gamma\gamma'$ -dibenzophenoxazine, 9-anilino-5-imino-, 1124¹.
- $C_{22}H_{17}N_3O_4$ 1(4)-Naphthalenone, 4-(1-anilino-4-nitro-2-naphthylimino)-2-hydroxy-, 1988⁵.
- 1,4-Naphthoquinone, 2-(1-anilino-4-nitro-2-naphthylamino)-, 1988⁵.
- $C_{22}H_{17}N_3O_6$ Anthraquinone, 2,7-dinitro, diphenylamine addn. compd., 1116¹, acenylamine addn. compd., 1116⁴.
- $C_{22}H_{17}N_3O_7$ Phenol, 7-nitro 4,4'-azoxybis-, dibenzoate, 1972⁴.
- $C_{22}H_{17}N_4$ Triazolo[2-*f*]quinoxaline, 2,7,8 triphenyl-, 2689⁴.
- $C_{22}H_{18}$ Anthracene, 9,10 diphenyl-, 1115⁵.
- $C_{22}H_{18}As_2N_2O_4$ 1,1'-(6,6'-Bi[phenarsazine]-5,5'-dicarboxylic acid, 1252².
- $C_{22}H_{18}Br_2O_2$ 9,10-Anthradial, 9,10-bis(*p*-bromophenyl)-9,10 dihydro-, 1115⁵.
- $C_{22}H_{18}Cl_2$ Anthracene, 9,10-bis(*p*-chlorophenyl)-9,10-dihydro-, 1115⁵.
- $C_{22}H_{18}Cl_2N_2O_5S_2$ α, α' -Bi-*o*-toluenesulfonic acid, α, α' -dichloro-5,5'-dinitro-(?), di Ph ester, 908⁹.
- 2,2'-Stilbenedisulfonic acid, *or, or'*-dichloro-4,4'-dinitro-(?), di-Ph ester, 908⁹.
- $C_{22}H_{18}Cl_2O$ 9-Anthrol, 1,5-dichloro-9,10-dihydro-9,10-diphenyl-, 3191⁷.
- $C_{22}H_{18}Cl_2O_2$ 9,10-Anthradial, 9,10-bis(*p*-chlorophenyl)-9,10-dihydro-, 1115⁵.
- , 1,5-dichloro-9,10-dihydro-9,10-diphenyl-, 3191⁷.
- $C_{22}H_{18}Cl_2O_6Ti_2$ Compd. from Ph salicylate and $TiCl_4$, 739³.
- $C_{22}H_{18}K_2$ Anthracene, 9,10-dihydro-9,10-diphenyl-, 9,10-di-K deriv., 1115⁴.
- $C_{22}H_{18}N_2$ Quinoxaline, 2-(3-acenaphthenyl)-3-phenyl-, 1811².
- , 2,3,6-triphenyl-, 237³.
- $C_{22}H_{18}N_2O$ Fluorene, 2,2'-azoxybis-, 3362¹.
- $C_{22}H_{18}N_2O_2$ 1,2-Benzacridine, 5,6-dihydro-7-phthalimidomethyl-(α), 1122².
- $C_{22}H_{18}N_2O_6$ Phenol, azoxybis-, dibenzoate, 1972^{1,2}.
- $C_{22}H_{18}N_2O_6$ Anthraquinone, 2,7-dinitro-, acenaphthene addn. compd., 1116¹.
- $C_{22}H_{18}N_2O_8S_2$ Anthraquinonedisulfanilide, 1811^{5,6}.
- $C_{22}H_{18}N_2O_8S_2$ Disulfide, bis[α -(*p*-nitrophenyl-imino)benzyl], 2692².
- $C_{22}H_{18}N_2O_6$ Anthraquinone, 2,7-dinitro-, benzidine addn. compd., 1116⁴.
- $C_{22}H_{18}N_2O_6$ Ether, bis(2,4 dinitrobenzohydryl), 3905¹.
- $C_{22}H_{18}N_2O_4$ Osotetrazine, 2,3-bis(*o*-nitrophenyl) 5,6-diphenyl-(?), 2133³.
- $C_{22}H_{18}Na_2$ Anthracene, 9,10-dihydro-9,10-diphenyl-, 9,10-di-Na deriv., 1115⁴.
- $C_{22}H_{18}O_2$ 9,9'-Bi[fluorene]-9,9'-diol, 579⁶.
- 9,9'-Bixanthyl, 3055⁴.
- 3,3'-Spirobi[4,3 *b*-naphthopyran], 2-methyl-, 408³, 3197¹.
- $C_{22}H_{18}O_4$ 9,9'-Bixanthidol, 579⁶.
- $C_{22}H_{18}O_6$ Benzene, *p*-bis(3,4-methylenedioxy-cinnamyl)-, 2272⁸.
- $\Delta^2(9)$ - α -Furanacetic acid, 3-hydroxy-5-keto- α ,4-diphenyl-, Me ester, benzoate, 1110⁶.
- $C_{22}H_{18}BrO_2$ 9,10-Anthradial, 2-bromo-9,10-dihydro-9,10-diphenyl-, 1115⁵.
- $C_{22}H_{18}ClN$ 5,12-Diamino-7-phenyl- $\alpha\gamma'$ -dibenzo phenazonium chloride, 1988⁴.
- $C_{22}H_{18}ClO_2$ 9,10-Anthradial, 2-chloro-9,10-dihydro 9,10-diphenyl-, 1115⁵.
- 3 - [β - (2 - Hydroxy - 1 - naphthyl)vinyl]-2-methyl- β -naphthopyrylium chloride, 3197¹; - HCl , 408³.
- $C_{22}H_{18}ClO_6$ 3- β -(2-Hydroxy 1-naphthyl)vinyl]-2-methyl- β -naphthopyrylium perchlorate, 2900⁹.
- $C_{22}H_{18}Cl_2FeO_2$ 3- β -(2-Hydroxy-1-naphthyl)vinyl]-2-methyl- β -naphthopyrylium ferric chloride, 2900⁹.
- $C_{22}H_{19}N$ Di-*o*-fluorylamine, 3052¹.
- $C_{22}H_{19}NO_6$ $\Delta^2(9)$ - α -Furanacetic acid, 3-hydroxy-5 keto- α ,4-diphenyl-, Me ester, carbanilate, 1110⁶.
- $C_{22}H_{19}N_2$ Carbazole, 2,7-bis(benzalmino)-, 3199².
- Fluorene, 2,2'-aziminobis-, 1644¹.
- $C_{22}H_{19}N_2O_8$ Ketone, β -acenaphthenyl benzyl, α -acetate, 1811².
- $C_{22}H_{20}$ Anthracene, 9,10-dihydro-9,10-diphenyl-, 1115⁵.
- $C_{22}H_{20}Br_2O_2$ Benzene, *p*-bis(5-bromo-4-hydroxy-3-methoxycinnamyl)-, 2272⁸.
- $C_{22}H_{20}Br_3O$ Benzene, *p*-bis(α, β ,3-tribromo-4-hydroxy - 5 - methoxyhydrocinnamyl)-, 2272⁸.
- $C_{22}H_{20}Cl_2O_2Zr$ Addn. compd. of $ZrCl_4$ and $CaH_2CO_2CaH_2$, 1069³.
- $C_{22}H_{20}N_2$ Aniline, *N, N'*-diphenylacetylenebis-, $SnCl_4$ addn. compds., 3902¹.
- 3,3'-Bicarbazole, 9,9'-dimethyl-, 289⁸.
- Difluorylamine, amino-, 3362¹.
- $C_{22}H_{20}N_2O$ 2-Pyrrolidone, 3-(2-naphthylimino-1,5-diphenyl-, 2903¹.
- $C_{22}H_{20}N_2O_2$ Benzamide, *N, N'*-(4-phenyl-*o*-phenylene)bis-, 237³.
- Hydrazine, α, β -bis(*p*-phenylbenzoyl)-, 1455³.
- Phthalide, 2,2-bis(2-methyl-3-indyl)-, 241⁵.
- o*-Toluic acid, α -(2-methyl-3-indyl)- α -(2-methyl-3-pseudoindividene)-, and salts, 242^{2,3}.
- α, α' -*o*-Xylenediol, α, α' -bis(2-methyl-3-pseudo-individene)-, 242².
- $C_{22}H_{20}N_2O_6$ Cinchoninic acid, 6-(*p*-acetamidophenyl)-2-styryl-, 2473⁷.

- C₂₂H₂₀N₂O₄ β -Butenic acid, α, α' -*p*-phenylene-dilimnabis(γ -phenyl-, 2902².
2,3-Pyrrolidinedione, 1,1'-*p*-phenylenebis-[5-phenyl-, 2903¹.
C₂₂H₂₀N₂O₄ Azobenzene, *p, p'*-bis(*p*-hydroxybenzalamino-), 402².
C₂₂H₂₀N₂O₄ Azobenzene, *p, p'*-bis(3,4-dihydroxybenzalamino-), 402².
C₂₂H₂₀N₂O₄S 5,12-Diamino-7-phenyl- α, α' -dibenzophenazonium hydrogen sulfate, 1988⁴.
C₂₂H₂₀N₂O₄ Benzil, bis(*o*-nitrophenylhydrazone), 2133⁴.
—, *m, m'*-dinitro-, osazone, 1983⁴.
C₂₂H₂₀N₂O₄S₂ Diphenylamine, 3,3''-dithiobis-[4'-methyl-4,6-dinitro-, 2691¹.
C₂₂H₂₀O₄ Naphthopyran, 1-benzal-3-*o*-tolyl-, 3197¹.
C₂₂H₂₀O₄ Δ^1 -Cyclopentenone, 2-benzal-5-methyl-4-(3,4-methylenedioxyphenyl)-3-phenyl-, 576².
C₂₂H₂₀O₄ 1,4-Naphthalenediol, 2-(4-hydroxy-1-naphthyl)-, triacetate, 2887⁷.
C₂₂H₂₀O₄S₂ 2,2'-Stilbenedisulfonic acid, di-Ph ester, 909².
C₂₂H₂₀O₄ Arabonic acid, lactone, tribenzoate, 1446².
Ribonic acid, lactone, tribenzoate, 1446².
C₂₂H₂₀BrO₄ Meconin, 2,2'-(5-bromo-4-hydroxy-*m*-phenylene)bis-, 3357¹.
C₂₂H₂₀N Benzohydrylamine, *N*-diphenylmethylene-, 3052⁴.
C₂₂H₂₀NO₄S Quinaldine, 8-methoxy- α -piperonylidene-3-*p*-tolylsulfonfyl-, 411¹.
C₂₂H₂₀NO₄S Quinaldine, 3-(*o*-anisylsulfonfyl)-8-methoxy- α -piperonylidene-, 412¹.
C₂₂H₂₀NO₄U + 3H₂O Pyridine tri-*p*-hydroxybenzoatouranate, 2231¹.
+ H₂O Pyridine trisalicylatouranate, 2231¹.
C₂₂H₂₀N₂O₄S Histidine, 2,4-dinitro-1-naphthol-7-sulfonate, 914¹.
C₂₂H₂₀N₂ Ketone, 3-acenaphthenyl benzyl, phenylhydrazine, 1811².
C₂₂H₂₀N₂O Anisole, *p*-triphenylmethylazo-, 1455².
C₂₂H₂₀N₂O₂ Indole, 2,2'-piperonylidenebis[3-methyl-, 1118².
Naphthalanilide, *N, N'*-dimethyl-, 2682².
C₂₂H₂₀N₂O₄S₂ 2,2'-Stilbenedisulfonic acid, 4,4'-diamino-, di-Ph ester, 909².
C₂₂H₂₀N₂O₄S₄ *m*-Toluenesulfonic acid, 6-hydroxy-5-(phenylsulfamyl)-, bimol. cyclic sulfonyle, 3897².
C₂₂H₂₀N₄ Benzil, osazone, SnCl₄ addn. compds., 3901¹.
C₂₂H₂₀N₂O₂ Acenaphthoquinone, 1,6-dimethoxy-, bis(phenylhydrazine), 1646¹.
C₂₂H₂₀N₂O₄ Benzidine, *N, N'*-dimethyl-2,2'-dinitro-*N, N'*-diphenyl-, 379².
C₂₂H₂₀N₂O₄S₂ 4',4''-Bi[*p*-toluenesulfonanilide], 2',2''-dinitro-, 2680².
C₂₂H₂₀N₂O₄S₂ 1,1'-Dimethyldipyridinium 4,4'-dinitro-2,2'-tolandisulfonate, 908².
C₂₂H₂₀O Ether, tolyl triphenylmethyl, 579², 580², 2470².
Phenol, α, β -triphenylethyl-, 580², 2470².
C₂₂H₂₀O₄ Isophthalic acid, 4,6-bis(α -hydroxydimethylbenzyl)-(?), dilactone, 1458².
1,2-Pyran-2-ol, 2-(2,4-cresyl)-4,6-diphenyl-, acetate, 410².
Terephthalic acid, 2,5-bis(α -hydroxydimethylbenzyl)-(?), dilactone, 1458².
C₂₂H₂₀O₄ Isoflavone, 5-hydroxy-7,4'-dimethoxy-6-methyl-2-styryl-, 249².
2-*o*-Quinopyran, 4,6-di-*p*-anisyl-4'-methoxy-, 410².
C₂₂H₂₀O₄ Benzene, *p*-bis(4-hydroxy-3-methoxycinnamyl)-, 2272².
Benzopinacol, tetrahydroxy-, *disperchlorate*, 2894².
Isophthalic acid, 4,6-dixyl- (?), 1458².
2-*o*-Quinopyran, 4-*p*-anisyl-6-(2-hydroxy-*p*-anisyl)-4'-methoxy-, 410².
Terephthalic acid, 2,5-dixyl- (?), 1458².
C₂₂H₂₀O₄ Meconin, 2,2'-(4-hydroxy-*m*-phenylene)bis-, 3357¹.
C₂₂H₂₀O₄ 1,4-Naphthalenediol, 2-(3,4,5-trihydroxyphenyl)-, pentaacetate, 2887⁷.
C₂₂H₂₀O₄S₂ Benzene, *p*-bis(4-hydroxy-3-methoxy-5-sulfocinnamyl)-, 2273².
C₂₂H₂₀ClO₄ 2,4-Di-*p*-anisyl-6-(2-hydroxy-*p*-anisyl)pyrylium perchlorate, 410².
C₂₂H₂₀ClO₄ 4-*p*-Anisyl-2,6-bis(2-hydroxy-*p*-anisyl)pyrylium perchlorate, 410².
C₂₂H₂₀N Aniline, α, β -triphenylethyl-, 3359².
Toluidine, *N*-triphenylmethyl-, 3359².
C₂₂H₂₀NO₄ Pyridine, 2,4-di-*p*-anisyl-6-(2-hydroxy-*p*-anisyl)-, 410².
C₂₂H₂₀NO₄S Quinaldine, α -benzal-8-methoxy-3-(phenethylsulfonfyl)-, 411¹, 412¹.
C₂₂H₂₀N₂O 5- γ -Isobenzophenoxazine, 9-diethylamino-5-phenylimino-, -HCl, 744¹.
Semicarbazide, 4-phenyl-1-triphenylmethyl-, 1455².
C₂₂H₂₀Br₂N₂O₄S₂ 1,1'-Dimethyldipyridinium α, α' -dibromo-5,5'-dinitro- α, α' -bi-*o*-toluenesulfonate, 908².
C₂₂H₂₀ClNO₄ 1-Phenyl-4,6-di-*p*-tolyl-2-picolinium perchlorate, 1814¹.
C₂₂H₂₀Cl₂N₂O₄S₂ 1,1'-Dimethyldipyridinium dichloro-5,5'-dinitro- α, α' -bi-*o*-toluenesulfonate, 908².
C₂₂H₂₀I₂N₂ Aniline, diiodoacetylenetetrakis-, *tetraiodide*, 2894².
C₂₂H₂₀N₂ Benzidine, dimethyldiphenyl-, 2898².
C₂₂H₂₀N₂O Hydrazine, α, β -anisyl- β -triphenylmethyl-, 1456¹.
C₂₂H₂₀N₂O₂ Creosol, α, α -bis(2-methyl-3-indyl)-, 1118².
C₂₂H₂₀N₂O₄S Hydrocinnamanilide, *N*-methyl- α -(2-naphthylsulfonamido)-, 3355¹.
C₂₂H₂₀N₂O₄S Cystine, bis(2-naphthylsulfonfyl)-, 3185².
C₂₂H₂₀N₂O₄ Malonic acid, (β -hydroxy- γ -phthalimidopropyl)phthalimido-, di-Et ester, 62².
C₂₂H₂₀N₄ Ethylene, tetrakis(*p*-aminophenyl)-, 2893².
C₂₂H₂₀N₂O₄S₂ 1,1'-Dimethyldipyridinium 4,4'-dinitro-2,2'-stilbenedisulfonate, 908².
C₂₂H₂₀O₄ 1,2-Pyran-2-ol, 4,6-di-*p*-anisyl-2-(2-hydroxy-*p*-anisyl)-, 410².
C₂₂H₂₀O₄ 1,2-Pyran-2-ol, 4-*p*-anisyl-2,6-bis(2-hydroxy-*p*-anisyl)-, 410².
C₂₂H₂₀GeN Germane, (*p*-dimethylaminophenyl)-triphenyl-, and -HCl, 2897¹.
C₂₂H₂₀NO Acetamide, *N, N*-diethyl- α, α -di-1-naphthyl-, 2888².
C₂₂H₂₀N₂O₄ Glycolamide, *N, N*-diethyl- α, α -di-1-naphthyl-, 2888².
C₂₂H₂₀N₂O₄ Homopiperonylamide, 6-[(homopiperonylmethylamino)methyl]-, picrate, 1270².
C₂₂H₂₀N₂O 1,2-Pyran, 2-methyl-2-(β -phenylhydrazino)-4,6-di-*p*-tolyl-, 1814¹.
C₂₂H₂₀ClO₄ Benzopinacol, tetraamino-, *dischloroate*, 2894².

- $C_{11}H_{15}N_4O_{10}$ Butyric acid, γ -benzoyl- α -methyl-amino- β -phenyl-, Et ester, picrate, 906⁶.
- $C_{11}H_{15}N_4O_{10}S_2$ Benzenesulfonic acid, *m*-nitro-, tolidine salt, 1103⁹.
- $C_{11}H_{15}N_4O_{10}S_2$ Benzenesulfonic acid, *m*-nitro-, bianisidine salt, 1103⁹.
- $C_{12}H_{18}O$ Cyclohexanone, 2-benzal-6-(2-benzal-cyclohexylidene)-, 231¹.
- $C_{12}H_{18}OSi_2$ Silicic oxide, *s*-dimethyltetraphenyl-, 1251¹.
- $C_{12}H_{17}NO_{11}U$ Piperidine tri-*m*-hydroxy-benzoato-uranate, 2231¹.
- Piperidine tri-*p*-hydroxybenzoato - uranate, 2231¹.
- $C_{12}H_{17}N_2O_{11}$ Codeinone, dihydro-, isoxime, picrate, Ac deriv., 2698¹.
- $C_{12}H_{17}BrClN_2O_7$ Pyruvic acid, bromochloro-, brucine salt, 3600⁶.
- $C_{12}H_{17}N_2O$ Benzamide, *N*-[*p*-[(1,2,3,4-tetrahydro - 2 - naphthylamino)methyl]phenethyl]-, 566⁷.
- $C_{12}H_{17}N_2O_2$ Acetamide, α -benzamido-*N*-(β -hydroxy - α - methyl - γ , γ' - diphenylisobutyl)-, 568^{8,7}.
- $C_{12}H_{17}N_2O_4$ Piperazine, 1,4-bis(γ -phthalimidopropyl)-, *di-HBr*, 566⁸.
- $C_{12}H_{17}N_2O_4$ Phenol, 2,4-bis(6-nitrocarvacrylazo)-, 903⁴.
- $C_{12}H_{17}N_2O_5$ Resorcinol, 2,4-bis(6-nitrocarvacrylazo)-, 903⁴.
- $C_{12}H_{17}O_{10}$ Shikouin, dihydro-, pentaacetate, 2905¹.
- $C_{12}H_{17}O_{11}$ Alizarin, diglucose, 2904⁴.
- Ruberythrinic acid, 2904⁴.
- $C_{12}H_{15}N_2O_7S_2$ 2 Naphtholdisulfonic acid, xylylidene salt, 1646⁹.
- $C_{12}H_{15}N_2O_7S_2$ 2 Naphtholdisulfonic acid, *p*-phenetidine salt, 1646⁹.
- $C_{12}H_{15}O$ Carbinol, bis(2,4-dimethoxyphenyl)-(2,4,6-trimethoxyphenyl)-, 1982⁷.
- $C_{12}H_{15}O_2$ Quercimeritrin, penta-Me ether, 1267⁴.
- $C_{12}H_{15}NO_2$ Pyrrole, 1-cyclohexyl-2,3-diethoxy-4,5-diphenyl-, 2882⁷.
- $C_{12}H_{15}N_2O_2$ Porphyrone, Me ether, phenylhydrazine, 589⁴.
- $C_{12}H_{15}N_2O_2$ Camphor, 3,3'-*m*(and *p*)-phenylene-diiminobis-, 2266⁹.
- $C_{12}H_{15}N_2O_4$ 3-Pyrrolicarboxylic acid, 5,5'-(α -methylbeuzal)bis[2,4-dimethyl-, di-Et ester, 381⁴.
- $C_{12}H_{15}N_2O_7S$ Valeric acid, α -sulfo-, strychnine salt, 3600⁶.
- $C_{12}H_{15}O_4$ Δ^2 -2-Butenone, 4-(3-methoxy-*p*-phenetyl)-, dimer, 3812¹.
- $C_{12}H_{15}O_7$ Vanillin, acetate, compd. with dimethyl-1,3-cyclohexanedione, 2253².
- $C_{12}H_{15}NO_2$ Cubebol, 1-naphthalenecarbamate, 577⁷.
- $C_{12}H_{15}N_2O_{14}$ 1,2,9,10-Anthratoetrol, 9,10-diamino - 9,10 - dihydro-, 1,2 - diglucose, 2904⁴.
- $C_{12}H_{15}O_4$ 3 - Dodecanone, 1 - (4 - hydroxy - *m*-anisyl)-, benzoate, 3623⁸.
- $C_{12}H_{15}BrO_{17}$ Cellobiose, heptaacetyl bromo-, 357².
- 4-Glucosidomannose, heptaacetyl bromo-, 357².
- $C_{12}H_{15}ClO_{17}$ Cellobiose, heptaacetyl chloro-, 357².
- 4-Glucosidomannose, heptaacetyl chloro-, 357².
- $C_{12}H_{15}FO_{17}$ 4-Glucosidomannose, heptaacetyl fluoro-, 357².
- $C_{12}H_{15}IO_{17}$ Cellobiose, heptaacetyl iodo-, 357².
- 4-Glucosidomannose, heptaacetyl iodo-, 357².
- $C_{12}H_{15}N_2O_2$ Porphyrone, Me ether, phenylhydrazine, 589⁴.
- $C_{12}H_{15}N_2O_2$ Benzyldiethylmethylphenylphosphonium camphorsulfonate, 66¹.
- $C_{12}H_{15}N_2O_2$ *p*, *p'*-Bicnanthanilide, 2884¹.
- $C_{12}H_{15}N_2O_4$ Adipic acid, α , δ -bis(*p*-methylbenzyl-amino)-, di-Et ester, 412⁹.
- Brucidine, ethoxymethyldihydro-, 3367¹.
- Cyclohexylamine, *N*-phenyl-, oxalate, 1102⁹.
- $C_{12}H_{15}N_4$ 2-Tetrazene, *s*-dicyclohexyldi-*p*-tolyl-, 1102⁹.
- $C_{12}H_{15}N_2O_2$ Piperazine, 1,4-bis(δ -benzamidobutyl)-, *di-HCl*, 566⁸.
- $C_{12}H_{17}ClN_2O_4$ Brucidine, dihydromethoxymethyl-, methochloride, 3367^{2,1}.
- $C_{12}H_{17}N_2O_4$ Brucidine, dihydromethoxymethyl-, methiodide, 3367^{2,1}.
- $C_{12}H_{17}N_2O_4$ Brucidine, dioxymethoxymethyl-dihydro-, methiodide, 3367⁴.
- $C_{12}H_{17}N_2O_5$ Urea, α -[β -(hydroxymethyl)- β -butyl- α -methylhexyl]- β -phenyl-, carbanilate, 334⁷.
- $C_{12}H_{17}N_2O_6$ Cetylamine, *N*-(1,6,8 trinitro-2-naphthyl)-, 1962³.
- $C_{12}H_{17}O_4$ Citral, compd. with dimethyl-1,3-cyclohexanedione, 2253².
- $C_{12}H_{17}O_6$ Galactose, diacetonetetraacetylglucosido-, 1635¹.
- $C_{12}H_{17}ClN_2O_4$ Brucidine, tetrahydromethoxymethyl-, methochloride, 3367⁷.
- $C_{12}H_{17}N_2O_4$ Brucidine, tetrahydromethoxymethyl-, methiodide, 3367⁷.
- $C_{12}H_{17}N_2O_4$ Cetylamine, *N*-(2,4-dinitro-1-naphthyl)-, 1962³.
- $C_{12}H_{17}N_2O_5$ Ethylhydroxyphenylpropylammonium tartrate, 65⁸.
- $C_{22}H_{40}O$ Ergosterol, 2722^{2,1}.
- $C_{22}H_{40}O_2$ Citronellal, compd. with dimethyl-1,3-cyclohexanedione, 2253².
- $C_{22}H_{40}O_4$ Chenodesoxybilibanolic acid, di-Me ester, 101⁴.
- $C_{22}H_{40}O_5$ Reductoisobilibanolic acid, di-Me ester, 101⁴.
- $C_{22}H_{40}O_6$ Tetramethyl ester, m. 133°, of ketotetracarboxylic acid of the cholic acid group, 1992⁴.
- $C_{22}H_{42}O_4$ Cholanolic acid, hydroxyketo-, Et ester, 1991¹.
- Citogenin, 299².
- $C_{22}H_{42}O_2$ Oxidation product of rubber, 1901⁸.
- Succinic acid, α , β dimethoxy-, dibornyl esters, 110⁶.
- $C_{22}H_{42}NO_4$ Cholanolic acid, hydroxyketo-, Et ester, oxime, 1991¹.
- $C_{22}H_{42}NO_6$ Glycocholic acid, 951⁴, 3211¹.
- $C_{22}H_{42}N_2O_2$ Capramide, *N*, *N'*-*p*-phenylenebis-, 2884⁴.
- $C_{22}H_{42}O$ + H_2O Phytosterol from bark, 599⁸.
- $C_{22}H_{42}O_2$ Ac deriv. from alcohol from mistletoe berries, 600⁴.
- Hydroxyketone, m. 96-7°, from Et etiocholanate, 591⁴.
- $C_{22}H_{42}O_2$ Ac deriv. of alcohol from bark, 600¹.
- $C_{22}H_{42}NO_5S$ Taurocholic acid, 951⁴, 3211¹.
- $C_{22}H_{42}N_2O$ Ketone, methyl norcholyol, semicarbazone, 591⁴.
- $C_{22}H_{42}O$ Norcholylicarbinol, dimethyl-, 590⁶.
- $C_{22}H_{42}N_2O_4$ Adipic acid, α , δ -bis(5-ethyl-2-methyl-1,1-piperidyl)-, di-Et ester, 60⁴.
- $C_{22}H_{42}O_2$ Chaulmoogric acid, α -methylheptyl ester, 572¹.
- Tridecenic acid, tridecenyl ester, 2873³.

- C₂₇H₅₀Br₄Cl₄N₁₆Sn, 213⁹.
 C₂₇H₅₀O₂ Lauric acid, α -acetyl- α -decyl-, Et ester, 2659¹.
 C₂₇H₅₀O₄ 1,20-Eicosanedicarboxylic acid, di-Et ester, 391¹, 3182⁹.
 1,24 - Tetracosanedicarboxylic acid, 390⁹, 3182⁹.
 C₂₇H₅₁N₇O₈ Allomucic acid, menthylamine salt, 1258⁹.
 Mucic acid, menthylamine salt, 1258⁹.
 C₂₇H₅₀O₂ Arachidic acid, Bu ester, P 593⁹.
 Palmitic acid, decyl ester, 2658⁹.
 C₂₇H₅₄O Ceryl alcohol, 599⁹, 600⁹.
 C₂₇H₅₄O₂ Truxenquinone, 2666⁷.
 C₂₇H₅₁ See *Truxene*.
 C₂₇H₃₄Cl₂ Anthracene, 9-benzyl-1,5-dichloro-10-phenyl-, 3191⁹.
 C₂₇H₃₁N₃O₂ Phthalimide, N -[p -(p -benzylaminophenyl)phenyl]-, 80⁹, 2891⁹.
 C₂₇H₃₁N₃O₂ Phthalimide, N -[p -(p -salcylalaminophenyl)phenyl]-, 80⁹.
 C₂₇H₃₁N₃O₂ 3-Indenecarboxylic acid, 2,2'-methylenebis[1-keto-, monophenylhydrazine, 3900⁹.
 C₂₇H₃₁N₃O₂ Phthalimide, α , α' , α'' -nitrilotris-(N -methyl-, 1627¹.
 C₂₇H₃₁O₂ Spiro[1,2 - benzopyran - 2,3'-4,3- β -naphthopyran], 3(or 2')-phenyl-, and perchlorate, 408⁹.
 C₂₇H₃₁O₂ Truxone, 1635⁹.
 C₂₇H₃₁N₃O₂ 2-Naphthol, [(4-nitro-*o*-tolylazo)-1-naphthylazo]-, 380⁹.
 C₂₇H₃₀ Anthracene, 9-benzyl-10-phenyl-, 3191⁹.
 C₂₇H₃₀Cl₂O 9-Anthrol, 9-benzyl 1,5-dichloro-9,10-dihydro-10-phenyl-, 3191⁹.
 C₂₇H₃₀O₂ 3,3' - Spirobi[4,3 - β - naphthopyran], 2,2'-dimethyl-, 3195⁹.
 C₂₇H₃₀O₂ Ketone, 3-acenaphthenyl α -hydroxybenzyl, benzoate, 1811³.
 C₂₇H₂₉BrCl₂N₂ 9 - Anthracenemethylamine, 10-anilino - 9 - bromo - 1,5 - dichloro-9,10-dihydro- N -phenyl-, 1260⁹.
 C₂₇H₂₈ Propene, 1,1,2,3-tetraphenyl-, 3902⁶.
 C₂₇H₂₈Br₂O₂ Meconin, 2,2' (4-hydroxy 5-*m*-tolylene)bis[4-bromo-, 3357¹.
 C₂₇H₂₈N₂O Diimide, α -(α -toluyl)- β -triphenylmethyl-, 1455⁷.
 C₂₇H₂₇N₂O₂S₂ Benzosulfonazole, 1-benzyl-2-[(*o*-carboxyphenyl)sulfonylimino] - 1,2-dihydro-, benzyl ester, 2884³.
 C₂₇H₂₇N₂O₂U *m*-Nitroaniline trisalcylatouranate, 2231³.
 C₂₇H₂₇N₂O 6 - Phenomazine - N' - anthranilaldehyde, 5,6-dihydro-, N -phenyloxime, 1641⁹.
 C₂₇H₂₇O 9-Anthrol, 9-benzyl-9,10-dihydro-10-phenyl-, 3191⁹.
 C₂₇H₂₆O₂S₂ Xanthone, dibenzyl mercaptole, 2674⁹.
 C₂₇H₂₆O₂ 3,4,5,6-Xanthenetetrrol, 9-phenyl (?), tetraacetate, 1983¹.
 C₂₇H₂₆O₁₀ Tetraacetate, decomps. 150-5⁹, of carbinol from pyrogallolbenzein, 1982⁹.
 C₂₇H₂₆S₂ 9-Fluorenone, dibenzyl mercaptole, 2674⁹.
 C₂₇H₂₆ClN₂ N , N - Dimethyl - 5,5 - diphenylcarbazimium chloride, 2268⁹.
 C₂₇H₂₆ClO₂ 2-*p*-Anisyl - 6 - (2,4 - cresyl) - 4-phenylpyrylium perchlorate, acetate, 410⁹.
 C₂₇H₂₆NO Benzamide, N - β -triphenylethyl-, 2671¹.
 C₂₇H₂₆NO₂ Quinaldine, 8 methoxy-3-(phen-
 etylsulfonyl) - α - piperonylidene-, 411⁹, 412⁹.
 C₂₇H₂₆NO₂U Aniline trihydroxybenzoatouranate, 2231³.
 C₂₇H₂₆N₂ Carbazine, 7-dimethylamino-5,5-diphenyl-, 2268⁹.
 C₂₇H₂₆N₂O₁₁ Carbanilide, bis[(arsono-hydroxyphenyl)carbamy], P 3626⁹.
 C₂₇H₂₆N₂ Acridan, 3-dimethylamino-5,5-diphenyl-, -HCl, 2268⁹.
 C₂₇H₂₆N₂O α -Toluic acid, triphenylmethylhydrazide, 1455⁷.
 C₂₇H₂₆N₂O₄ Quinoline, 3-(*o* - carboxyanilino)-4-(*o* - carboxyphenyl)-, di-Et ester, 90¹.
 C₂₇H₂₆N₂O₂S₂ Hydrazine, α (p -hydroxyphenyl)- α , β - bis(p - tolylsulfonyl)-, benzoate, 68⁹.
 C₂₇H₂₆N₂O₂ 1(2) - Phthalazinone, α , α' , α'' -nitrilotris[4-methylamino-(?)], 1627¹.
 C₂₇H₂₆O₂ 1,2-Pyran-2-ol, 6-*p*-anisyl-2-(2,4-cresyl)-4 phenyl-, acetate, 410⁹.
 C₂₇H₂₆O₂ Meconin, 2,2'-(hydroxytolylene)bis-3357¹.
 Meconin, 2,2' - (4 - methoxy-*m*-phenylene)bis-, 3357¹.
 C₂₇H₂₆N₂ Acridan, 2-amino-7-dimethylamino-5,5-diphenyl-, 2268⁹.
 C₂₇H₂₆Br₂N₂O₂ Pseudocumenol, 3,6-dibromo- α' - [p - (diallylamino)phenyl]-, picrate, 903¹.
 C₂₇H₂₆N₂O₂S₂ p - Toluenesulfonanilide, p' , p''' -methylenebis-, 2891⁹.
 C₂₇H₂₆ClN₂O₄ 1 - (N - Methylanilino)-4,6-di-*p*-tolyl-2-picolinium perchlorate, 1814¹.
 C₂₇H₂₆ClO₂Zr Compd. from ZrCl₄ and mandelic acid 1069⁹.
 Compd. from ZrCl₄ and mandelic acid 1069⁹.
 C₂₇H₂₆CoO₂, 1416⁹.
 C₂₇H₂₆NO₁₁ Benzyl alcohol, 3,4,5-trihydroxy-, tris(ethyl carbonate), naphthylurethan, 2880⁹.
 C₂₇H₂₆N₂O 2 Naphthol, 1-[p -(benzylbutylamino)phenylazo]-, 2884³.
 C₂₇H₂₆Br₂O 3-*p*-Toluenone, 4 - [(5-hydroxycarvacryl)phenylmethylene]-, dibromo deriv., 1456⁹.
 C₂₇H₂₆Br₂O₂S Bromothymol blue, 2235⁴.
 C₂₇H₂₆N₂O₂ Hydrazine, α , α -dibenzoyl- β -cyclohexyl- β -*o*-tolyl-, 1102⁹.
 C₂₇H₂₆N₂O Hydrohydrastinine, 1-(4-benzyl-oxy-5-methoxy - 2 - nitrobenzyl)-3-methyl-, 1990⁹.
 3 - *p* - Tolueneone, 4 - [(5 - hydroxycarvacryl)phenylmethylene]-, dinitro deriv., 1456⁹.
 C₂₇H₂₆IN₂O Pinacyanol iodide, 6-ethoxy-1,1'-diethyl-, 3201⁹.
 C₂₇H₂₆NaO₂ 3-*p*-Toluenone, 4-[(5-hydroxycarvacryl)phenylmethylene]-, Na deriv., 1456⁹.
 C₂₇H₂₆N₂O₁₄ Cadaverine, N -(1,2,3,4-tetrahydro-2-naphthyl)-, dipicrate, 566⁹.
 C₂₇H₂₆O₂ 3-*p*-Toluenone, 4-[(5-hydroxycarvacryl)phenylmethylene]-, and salts, 1456⁹.
 C₂₇H₂₆O₂S Thymolsulfonephthalein, 1773⁹, 2834³.
 C₂₇H₂₆O₂ Δ^2 - Cyclohexenecarboxylic acid, 6 - (3,4 - dimethoxyphenyl) - 4 (3,4-dimethoxystyryl)-2-keto-, Et ester, 3611⁹.
 C₂₇H₂₆O₁₄ + H₂O See *Glucosfrangulin*.
 C₂₇H₂₆O₁₅ Rutin, 1267⁹.

- C₂₇H₅₁NO₁₁U Triethylamine trisacilylouranate, 2231².
- C₇H₅O₂ Thymol, 6,6'-benzalbis-, 1456⁴.
- C₂₇H₄₅LiO₂ Lithium triphenylmethyl, EtO₂ compd., 892¹.
- C₂₇H₄₅N₂ 1,7-Heptanediamine, *N*, *N'*-bis-(1,2,3,4 - tetrahydro - 2 - naphthyl)-, and di-HCl, 567¹.
- C₂₇H₄₅IN₂O₄ Brucidine, ethoxymethyldihydro-, methiodide, 3367².
- C₂₇H₄₅N₂O₁₆ Dimethyl ester, m. 197°, of trinitrodicarboxylic acid from quillaic acid, 590¹.
- C₂₇H₄₅Cl₂N₂O₄ Brucidine, dihydromethoxymethyl-, dimethochloride, 3367⁴.
- C₂₇H₄₅I₂N₂O₄ Brucidine, dihydromethoxymethyl-, dimethiodide, 3367⁴.
- C₂₇H₄₅N₂O₂ See *Vazine*.
- C₂₇H₄₅N₂O₂S Brucidine, dihydromethoxymethyl-, methosulfate, 3367².
- C₂₇H₄₅O₁₂ Glucoheptoside, pentaacetyl- β -borneol- α -, 2252².
- Glucoheptoside, pentaacetyl- β -geraniol- α -, 2252¹.
- C₂₇H₄₅Cl₂N₂O₄ Brucidine, tetrahydromethoxymethyl-, dimethochloride, 3367².
- C₂₇H₄₅I₂N₂O₄ Brucidine, tetrahydromethoxymethyl-, dimethiodide, 3367².
- C₂₇H₄₅I₂N₂O₄ Brucidine, tetrahydromethoxymethyl-, dimethiodide, periodide, 3367².
- C₂₇H₄₅N₂O₁₆S₂ Strychnidine, dihydromethoxymethyl-, dimethosulfate, 3365².
- C₂₇H₄₅O Ergosterol, 1464¹.
- C₂₇H₄₅O₂ Cholestanedione, 1312².
- C₂₇H₄₅N₂O₁₆S₂ Strychnidine, tetrahydromethoxymethyl-, dimethosulfate, 3365².
- C₂₇H₄₅O₂ Cholestanedione, 1312².
- C₂₇H₄₅O₂ Cholestanedione, 1312².
- C₂₇H₄₅O₂ Trimethyl ester, m. 94°, of the hydroxytricarboxylic acid from chenodeoxybiliary acid, 101².
- C₂₇H₄₅N₂O₂ Cholesterol, pseudonitrosite, 889⁴.
- C₂₇H₄₅O (See also *Cholesterol*; *Sitosterol*.)
Phytosterol, 1290²
24-Pseudocholestanone, 248⁴
- C₂₇H₄₅Cl Ergostyl chloride, 1464².
- C₂₇H₄₅S Pseudocholestan, 248⁴.
- C₂₇H₄₅O Alcohol from bark, 599².
- Ergostanol, 1464².
- Sitostanol, 749².
- Sitosterol, dihydro-, 101¹, 758⁴.
- C₂₇H₄₅O₂ Cholestanetriol, 1312².
- Sitostantriol, 1312².
- C₂₇H₄₅N₂O₂ Compd., m. 150°, from pseudo nitrosite of cholesterol, 889⁴.
- C₂₇H₄₅N₂O See *Tolysin*.
- C₂₇H₄₅N₂O₂ Indanthrene, P 249⁴, 2561², P 2907¹.
- C₂₇H₄₅N₂O₂ Phthalimide, biphenylenebis-, 80⁶, 2800⁷.
- C₂₇H₄₅N₂O₂ Anthraquinone, 2,7-dinitro-, anthracene addn. compd., 1116²; phenanthrene addn. compd., 1116².
- C₂₇H₄₅N₂O₂ Phthalimide, *p*, *p'*-azobis[*N*-phenyl-, 402².
- C₂₇H₄₅N₂O₂ Indirubin, malonic acid, Et ester, Bz deriv., 89².
- C₂₇H₄₅N₂O₂ Anthraquinone, 2,7-dinitro-, stilbene addn. compd., 1116².
- C₂₇H₄₅N₂ 1,2-Benzofluorindine, 7-phenyl-, 2272².
- C₂₇H₄₅N₂O₁₆S₂ Thiophene, 2,4-diphenyl-, dipicrate, 8908².
- C₂₈H₃₀O₂S₂ Phthalic acid, dithiol-, di-2-naphthyl ester, 3192⁴.
- C₂₈H₃₀O₄ Naphtholphthalein, 2235⁴.
- C₂₈H₃₀O₄ 9,9' - Bi[xanthene]-9,9'-dicarboxylic acid, 3055².
- C₂₈H₃₀O₁₀ $\Delta^2(\gamma)$ - α - Furanacetic acid, 3-hydroxy-5 - keto - α ,4 - bis(3,4 - methylenedioxyphenyl)-, Me ester, benzoate, 1110⁴.
- C₂₈H₃₀ClN₂O₂ 5-Acetamido-12-nitro-7-phenyl- α , γ' -dibenzophenazonium chloride, 1988¹.
- C₂₈H₃₀NO₂ Oxindole, 3,3-di-1-naphthoxy-, 2472².
- C₂₈H₃₀N₂ Rosinduline, phenyl-, 98⁴.
- C₂₈H₃₀N₂O₂ 5 - Hydroxy - 9 - nitro-14-phenyl- α , α' - dibenzophenazonium acetate, 1988¹.
- C₂₈H₃₀N₂O Dibenzofluorindine, acetamido-, 2272².
- C₂₈H₃₀Br₂N₂O Creosol, α , α' -*p*-phenylenediaminobis[5,6-dibromo-, 2258⁴.
- C₂₈H₃₀N₂ Fluorenimidazole, (2 fluoryl)methyl-, 3362².
- Pyrazine, tetraphenyl-, SnCl₄ addn. compds., 3902¹.
- C₂₈H₃₀N₂O₂ 3,3'-Bicarbazole, 9,9'-diacetyl-, 914¹.
- C₂₈H₃₀N₂O₂ Glyoxylohydroxamanilide, *N*-benzoyl- α -phenyl-, Bz deriv., 1099¹.
- C₂₈H₃₀N₂O₁₆ Chalcone, 4-methyl-, dipicrate, 77¹.
- C₂₈H₃₀N₂S Indole, 3,3'-thiobis[2 phenylazo-, 1459².
- C₂₈H₃₀N₂ Azobenzene, oxalyl-4,4'-diamino-, 402².
- C₂₈H₃₀O₂ Benzohydrol, α -phenylethynyl-, benzoate, 1980².
- 3,3' - Trimethylenedi- β -naphthaspiropyran, 3195².
- C₂₈H₃₀O Compd., m. 275°, from *o*-phenylphenyl chloroacetate, 1117².
- C₂₈H₃₀O₂ Δ^5 - Cyclopentenone, 2-methyl-3,4-bis(3,4-methylenedioxyphenyl) - 5 - piperonylidene-, 5768².
- C₂₈H₃₀ClN₂O 5 - Acetamido - 12 - amino - 7-phenyl - α , γ' - dibenzophenazonium chloride, 1988¹.
- C₂₈H₃₀ClO₂ 8,9,10,11 - Tetrahydro - 8 - (2-hydroxy - 1 - naphthylmethylene)- α -benzoxanthylum chloride, 3195².
- C₂₈H₃₀ClO₂ 3 - [β - (2 - hydroxy-1-naphthyl)-vinyl] - 2 - methyl - β - naphthopyrylium perchlorate, acetate, 408².
- C₂₈H₃₀NO₂S Quinaldine, α -benzal-8-methoxy-3-(2-naphthylsulfonyl)-, 411⁴.
- C₂₈H₃₀N₂O₂ 5-Amino-9-hydroxy-14-phenyl- α , α' -dibenzophenazonium acetate, 1988¹.
- C₂₈H₃₀N₂O Anthraquinone, 2,7-dinitro-, di-*p*-tolylamine addn. compd., 1116².
- C₂₈H₃₀ Anthracene, 9,10-di-*p*-tolyl-, 1115⁴.
- C₂₈H₃₀As₂N₂O₂ 1,1'-(6,6') - Biphenarsazine, 6,6'-diacetyl-, 98⁴.
- C₂₈H₃₀Br₂N₂O Benzidine, *N*, *N'*-bis[2(and 6)-bromovanillal], 1803².
- C₂₈H₃₀Ca₂N₂O₂S₂ Benzisosulfonazole, 1,2-dihydro - 2 - tolylsulfonylimino-, calcium deriv., 2888².
- C₂₈H₃₀ClN₂O₂PtS₂ 4 - Nitro - 1 - *p* - tolyl-benzisothiazolium chloroplatinate, 2692².
- C₂₈H₃₀Cu₂N₂O₂S₂ Benzisosulfonazole, 1,2-dihydro - 2 - tolylsulfonylimino-, copper deriv., 2888².
- C₂₈H₃₀K₂ Anthracene, 9,10-dihydro-9,10-di-*p*-tolyl-, 9,10-di-K deriv., 1115⁴.

- C₂₂H₂₂N₂O₄ Indole, 3,3'-piperonylidenebis[1-acetyl-, 1118⁴.
- C₂₂H₂₂N₂O Anthranilaldehyde, *N* - [o-[o-(aminobenzal amino) benzal amino]-benzal-], and salts, 764.3.3.
- C₂₂H₂₂N₂O₂ 5,12 - Diamino - 7 - phenyl - α,γ' -dibenzophenazonium acetate, 1988⁴.
- C₂₂H₂₂N₂O₂S₂ Disulfide, bis(4-nitro- α -*p*-tolylimino-*o*-tolyl), 2602⁷.
- C₂₂H₂₂N₂O Anthraquinone, 2,7-dinitro-, tollidine addn. compd., 1116⁴.
- p*, *p'* - Biacetanilide, *N*, *N'*-bis(*o*-nitrophenyl)-, 913⁹.
- C₂₂H₂₂Na₂ Anthracene, 9,10-dihydro-9,10-di-*p*-tolyl-, 9,10-di-*Na* deriv., 1115⁴.
- V₂₂H₂₂O₂ Anthracene, 9,10-di-*p*-anisyl-, 1115⁴.
- Benzophenone, *p*, *p'*-ethylenebis-, 3616¹.
- 2 - Butene - 1,4 - diol, 1,1,4,4-tetraphenyl-, 2459¹.
- C₂₂H₂₂O₂S₂ 1,3-Benzodithiole, 2,2'-oxybis[2-*p*-anisyl-, 1985¹.
- C₂₂H₂₂O₇ Isoflavone, 5,7-dihydroxy-4'-methoxy-2-styryl-, diacetate, 246⁴.
- C₂₂H₂₂O₂ $\Delta^2(6)$. α - Furanacetic acid, α ,4-di-*o* - anisyl - 3 - hydroxy - 5 - keto-, Me ester, benzoate, 1110⁴.
- C₂₂H₂₂ClO₄ 1,4 - Benzopyran - 3 - carboxylic acid, 4 - [(*o*-chlorocinnamyl)methyl]-2-phenyl-, Et ester, 2259¹.
- C₂₂H₂₂N Divinylamine, β , β , β' , β' -tetraphenyl-, 52⁴.
- Indole, 2-methyl-3-triphenylmethyl-, 243⁴.
- C₂₂H₂₂NO₂ Benzamide, *o*-benzoyl-*N*-(β -hydroxy- β , β -diphenylethyl)-, 568⁴.
- 2 - Oxazolidinol, 2-(*o*-benzoylphenyl)-5,5-diphenyl-, and -HCl, 568⁴.
- Propionhydroxamic acid, β -triphenyl-, Bz deriv., 2671¹.
- C₂₂H₂₂As₂O₄ Dibenzoarsenole, 5,5'-oxybis[2,8-dimethoxy-, 905³.
- C₂₂H₂₂BaCl₂O₄ Thymolphthalein, tetrachloro-, Ba deriv., 1456⁴.
- C₂₂H₂₂Br₂Cl₂O₄ Thymolphthalein, dibromotetrachloro-, 1456⁴.
- C₂₂H₂₂Cl₄Na₂O₄ Thymolphthalein, tetrachloro-, di-*Na* deriv., 1456⁴.
- C₂₂H₂₂Cl₄O₂Pb Thymolphthalein, tetrachloro-, Pb deriv., 1456⁴.
- C₂₂H₂₂Cl₄O₂Zr Compd. from ZrCl₄ and benzoin, 1069⁴.
- C₂₂H₂₂N₂ 3,3'-Bicarbazole, 9,9'-diethyl-, 2898⁴.
- C₂₂H₂₂N₂O Crotonamide, *N*-(3-acenaphthenyl)- β -(3-acenaphthenylamino)-, 910⁴.
- C₂₂H₂₂N₂O₂ Benzidine, *N*, *N'*-dianisal, 402⁴.
- C₂₂H₂₂N₂O₂S₂ 2(1)-Quinazolone, 3,4-dihydro-4-hydroxy-3-phenyl-2-thio-, dimer, 587⁷.
- C₂₂H₂₂N₂O₄ 2(1)-Quinazolone, 3,4-dihydro-4-hydroxy-3-phenyl-, dimer, 587⁷.
- C₂₂H₂₂O₂ 9,10-Anthradiol, 9,10-dihydro-9,10-di-*p*-tolyl-, 1115⁴.
- 2-Butene-1,4-diol, 1,1,4,4-tetraphenyl-, 2459¹.
- C₂₂H₂₂O₄ 9,10-Anthradiol, 9,10-di-*p*-anisyl-, 9,10-dihydro-, 1115⁴.
- C₂₂H₂₂O₄ Δ^1 - Cyclopentenone, 2-anisal-3-*p*-anisyl - 5 - methyl - 4 - (3,4-methylene-dioxyphenyl)-, 570⁴.3.
- C₂₂H₂₂O₂ Isoflavone, 5-hydroxy-7,4'-dimethoxy-6-methyl-2-styryl-, acetate, 246⁴.
- C₂₂H₂₂Cl₄Na₂O₄ Thymolphthalein, tetrachloro-, mono-*Na* deriv., 1456⁴.
- C₂₂H₂₂NO₂U *o*-Toluidine tri-*p*-hydroxybenzoatouranate, 2231¹.
- o*-Toluidine trisacilyltouranate, 2231¹.
- C₂₂H₂₂N₂O₄ Dibenzoylisonitroso deriv., m. 148⁷, of base from BzCH₂CN and piperidine, 2902⁴.
- C₂₂H₂₂Cl₄O₄ Thymolphthalein, tetrachloro-, 1456⁴.
- C₂₂H₂₂CuO₄ γ,ϵ -Heptadienic acid, β -keto- δ -phenyl-, Me ester, Cu deriv., 2468⁹.
- C₂₂H₂₂CuO₄ δ -Hexenic acid, α,γ -diketo- ϵ -phenyl-, ethyl ester, copper deriv., 2901⁷.
- C₂₂H₂₂N₂O₄ Strychnine, *N*-oxide, benzoate, 384⁴.
- C₂₂H₂₂N₂O₁₀S₄ *m*-Toluenesulfonic acid, 6-hydroxy - 5 - (*p* - tolylsulfamyl)-, bimol. cyclic sulfonylide, 3897⁴.
- C₂₂H₂₂N₂O₁₁U Tolylenediamine trisacilyltouranate, 2231¹.
- C₂₂H₂₂N₂O₄ Benzidine, *N*, *N'*-bis(α -nitromethylbenzyl)-, 2254¹.
- C₂₂H₂₂N₂O₄ 2,3-Butanediamine, *N*, *N'*-diphenyl-, dipicrate, 1810¹.
- C₂₂H₂₂O₂ Ethanol, 2,2'-oxybis[1,1-diphenyl-, 2459¹.
- C₂₂H₂₂O₁₈ Alizarin, monoglucotetraacetate, 2904³.
- C₂₂H₂₂ClN₂O₄ Tetra-*p*-tolylhydrazinium perchlorate, 2672⁴.
- C₂₂H₂₂Ge Germane, ϵ tetrahenzyl-, 3897¹.
- C₂₂H₂₂GeO₁₂S₄ Germane, tetrakis(sulfohenzyl)-, 3897¹.
- C₂₂H₂₂N₂O Compd. from octamethylporphin, 2701⁴.
- C₂₂H₂₂Ba₂Bi₂O₄ Barium tartrobismuthate, 2623³.
- C₂₂H₂₂Bi₂Ca₂O₄ Calcium tartrobismuthate, 2623³.
- C₂₂H₂₂Bi₂K₂O₄ Potassium tartrobismuthate, 2623³.
- C₂₂H₂₂Bi₂Na₂O₄ Sodium tartrobismuthate, 2623³.
- C₂₂H₂₂CuN₂O₂S₂ 868⁴.
- C₂₂H₂₂CuO₄ Caproic acid, α,γ -diketo- ϵ -phenyl-, ethyl ester, copper deriv., 2901⁷.
- C₂₂H₂₂N₂O₁₂S₄ 2,2' - Stilbenedisulfonic acid, 4,4'-dinitro-, di-Me ester, bis(phenylhydrazine) deriv., 908⁷.
- C₂₂H₂₂O₂ Cyclohexanone, 2-*p*-anisal-6-(2-*p*-anisalcyclohexylidene)-, 231⁴.
- C₂₂H₂₂N₂O₁₁ Akuamine, picrate, 3623³.
- C₂₂H₂₂Br₂Co₂ Addn. compd. of CoBr₂ and benzyl alcohol, 1235¹.
- C₂₂H₂₂Br₂CuN₂ Isopyrrole, 2-(5-bromo-3,4-dimethyl - 2 - pyrrolmethylene) - 3,4,5-trimethyl-, Cu salt, 86¹.
- C₂₂H₂₂Cl₂CoO₄ Addn. compd. of CoCl₂ and benzyl alcohol, 1235¹.
- C₂₂H₂₂O₂ 3-*p*-Toluenone, 4-[(5-methoxycarvacryl)phenylmethylene], and -HCl, 1456⁴.
- C₂₂H₂₂CoN₂ Isopyrrole, 3,5-dimethyl-2-(3,4,5-trimethyl - 2 - pyrrolmethylene)-, Co salt, 85⁴.
- C₂₂H₂₂CuN₂ Isopyrrole, 3,5-dimethyl-2-(3,4,5-trimethyl - 2 - pyrrolmethylene)-, Cu salt, 85⁴.
- C₂₂H₂₂N₂O₇S₄ 2-Naphtholdisulfonic acid, pseudocumidine salt, 1046⁴.
- C₂₂H₂₂N₂NI Isopyrrole, 3,5-dimethyl-2-(3,4,5-trimethyl - 2 - pyrrolmethylene)-, NI salt, 85⁴.
- C₂₂H₂₂N₂Zn Isopyrrole, 3,5-dimethyl-2-(3,4,5-trimethyl - 2 - pyrrolmethylene)-, Zn salt, 85⁴.
- C₂₂H₂₂O₄ Δ^1 -Cyclohexenone, 5-(4-propoxy-m-

- anisol) - 3 - (4 - propoxy - 3 - methoxy - styryl) -, 3612¹.
- C₁₁H₁₅ClN₂Fe, 2855².
- C₁₁H₁₅CoN₂O₁₁ + 0.5H₂O, 868³.
- C₁₁H₁₅N₂O₄ Psychotrine, 2698⁷.
- C₁₁H₁₅N₂O₈ Valeric acid, α -sulfo-, drucine salt, 3600⁹.
- C₁₁H₁₅N₂O₁₀ Piperazine, 1,4-bis(β -aminoethyl)-, dipicrolonate, 566⁸.
- C₁₁H₁₅N₂O₁₁ 1,6-Hexanediol, 2,5-di-1-piperidyl-, dipicrate, and isomer, 598³.
- C₁₁H₁₅O₁₁ Amylobiose, octaacetyl-, 1472⁴.
- d-Glucose, 6- β -D-galactosido-, octaacetate, 1704⁷.
- 4-Glucosidomannose, octaacetyl-, 357².
- Melbiose, octaacetate, 2665⁸.
- C₁₁H₁₅N₂O₂ Anilide, m. 139-40^o, of acid from muscone, 901⁸.
- p, p'-Bicaprylanilide, 2884⁸.
- 2 - Pyrimidol, 4,6-epoxy-2,4,6-triethylhexahydro - 1,3 - diphenyl-5,5-dipropyl-, 3351².
- C₁₁H₁₅O₄ Albasapogenin, 1403⁷.
- Githagenin, 384⁷.
- Gypsogenin, 1463⁷.
- C₁₁H₁₅BiN₂O₈ Ammonium tartarobismuthate, 2623².
- C₁₁H₁₅NO₄ Githagenin, oxime, 384⁷.
- C₁₁H₁₅O₄ Ceterhinene, 1891⁴.
- Squalene, 1891⁴.
- C₁₁H₁₅O₄ Brassicid acid, Ph ester, 2126⁸.
- Erucic acid, Ph ester, 2126⁸.
- C₁₁H₁₅O₄ Acetate, m. 147^o, of the hydroxyketone from Et etiocholanate, 591¹.
- C₁₁H₁₅O₄ Isokessylpinacone, 3361⁷.
- Kessylpinacone, 3361⁷.
- C₁₁H₁₅NO Isocucanilide, 1629⁸.
- C₁₁H₁₅N₂O₁ Undecylamide, N, N'-p-phenylenebis-, 2884⁸.
- C₁₁H₁₅N₂O 24 - Pseudocholestanone, semicarbazone, 248⁸.
- C₁₁H₁₅O₈ Lactose, bis(di-Bu mercaptal), 64⁸.
- Maltose, bis(di Bu mercaptal), 64⁸.
- Sucrose, bis(di-Bu mercaptal), 64⁸.
- C₁₁H₁₅BrN₂O₄ Anthraquinone, 2,7-dinitro-, dibromomethylanthracene addn. compd., 1116².
- C₁₁H₁₅N₂O₄ Anthraquinone, 2,7-dinitro-, methylanthracene addn. compd., 1116².
- C₁₁H₁₅N₂O₄ 1,4-Naphthoquinone, 2-hydroxy-3-triphenylmethyl-, Na deriv., 241⁷.
- C₁₁H₁₅N₂O₄ Pyridine, 2,4,6-triphenyl-, N₂ oxide, picrate, 94⁸.
- C₁₁H₁₅N₂O₁₁ 1,2 - Benzacridine, 8-amino-5,8-dihydro-, dipicrate, 1122⁷.
- C₁₁H₁₅O 1 Naphtho[2,1,3-*peril*]pyran, 1-benzal-3-(1-naphthyl)-, 3197⁷.
- C₁₁H₁₅O₄ 1,4-Naphthoquinone, 2-hydroxy-3-triphenylmethyl-, 241⁷.
- C₁₁H₁₅NO₈ Quinaldine, 8-methoxy-3-(2-naphthylsulfonyl) - α - piperonylidene-, 411⁴.
- C₁₁H₁₅N₂O₄ Phthalimide, N-[4-(4-benzal-amino-m-anisyl)-o-anisyl]-, 2891⁸.
- C₁₁H₁₅N₂O₄ 1,2,5 - Triazole - 3,4 - dicarboxamide, 1 - (p - phenylcarbamyphenyl)-, 2690⁴.
- C₁₁H₁₅N₂O₄ 2,1,3 - Benzotriazol-5-ol, 4,4'-methylenebis[2-phenyl-, diacetate, 2689⁸.
- C₁₁H₁₅Br₂O₁₁ Chalcone, 4,4'-dimethyl-, dipicrate, 77¹.
- C₁₁H₁₅O₄ Compd., m. 213^o, from p-hydroxybenzaldehyde, AcO and AcONa, 1257⁹.
- C₁₁H₁₅O₄ 1,2,4-Naphthalenetriol, 3-benzohydryl-, triacetate, 241⁷.
- C₁₁H₁₅BrN₂ Carbocyanine, 1,1'-dimethyl- β -phenyl-, bromide, 412⁸.
- C₁₁H₁₅ClN₂ Carbocyanine, 1,1'-dimethyl- β -phenyl-, chloride, 412⁸.
- C₁₁H₁₅N₂O₄ Acridine, 2,5-bis(m - aminobenzamido)-7-ethoxy-, 2936⁸.
- C₁₁H₁₅N₂O₄ Acetamide, α -benzamido-N-(β -hydroxy - α , β , β -triphenylethyl)-, 568³.
- C₁₁H₁₅O₈ Isophthalic acid, 4,4'-(o-carboxybenzal)bis-, penta-Me ester, 579⁸.
- Terephthalic acid, 2,2'-(o-carboxybenzal)-bis-, penta-Me ester, 579⁸.
- C₁₁H₁₅N₂O₄ Acridan, 3-acetamido-7-dimethylamino-5,6-diphenyl-, 2268⁸.
- C₁₁H₁₅O₈ Benzophenone, p, p'-dimethoxy-, dibenzyl mercaptol, 2674⁴.
- C₁₁H₁₅S₂ 2-Propanone, 1,3-diphenyl-, dibenzyl mercaptol, 2674⁴.
- C₁₁H₁₅N₂O₄ 1,4-Heptanediol, bis(1-naphthalene-carbamate), 3053⁸.
- 3 - Pyrrolicarboxylic acid, 5,5'-diphenylmethylenebis[2 - methyl-, di-Et ester, 351².
- C₁₁H₁₅N₂O₈ Ethanesulfonic acid, 1-phenyl-, strychnine salt, 2673⁸.
- C₁₁H₁₅O₈ 3-p-Toluenone, 4-[(5-hydroxycarvacryl)phenylmethylene]-, acetate, 1456⁸.
- C₁₁H₁₅N₂O₄ Pinacyanol iodide, 6,6'-diethoxy-1,1'-diethyl-, 3201⁸.
- C₁₁H₁₅N₂O₄ Akuamine, methopicate, 3623⁴.
- C₁₁H₁₅N₂O₄ Emetamine, and salts, 2698⁷, 2699¹.
- C₁₁H₁₅N₂O₄ Methane, bis(5-methoxycarvacryl)-phenyl-, 1456⁴.
- C₁₁H₁₅N₂O₄ Psychotrine, O-methyl-, 2698⁷.
- C₁₁H₁₅N₂O₄ See Emetine.
- C₁₁H₁₅O₄ Ketone, bismorcholyl phenyl, 591¹.
- C₁₁H₁₅N₂O₁₀ Brucidine, tetrahydromethoxy methyl-, dimethohydrogen carbonate, 3367⁷.
- C₁₁H₁₅O₄ Pyroanthroquinovic acid, 2894⁴.
- C₁₁H₁₅N₂O₁₁ Brucidine, dihydromethoxymethyl-, dimethosulfate, 3367⁷.
- C₁₁H₁₅O₄ Pyroquinovic acid, 2894⁴.
- C₁₁H₁₅O₄ Oxidation product of rubber, 1901⁸.
- C₁₁H₁₅O₄ Quillaic acid, 299².
- Sapogenin, m. 294^o, from quillaic acid, 590¹.
- C₁₁H₁₅NO₄ Oxime, m. 282^o, of sapogenin from quillaic acid, 590¹.
- C₁₁H₁₅N₂O₄ Githagenin, semicarbazone, 384⁷.
- C₁₁H₁₅Br₂O₄ Sitosterol, dibromodihydro-, acetate, 101¹.
- C₁₁H₁₅N₂O₄ Allophanic acid, cholesterol ester, 750⁴.
- C₁₁H₁₅ClO₄ Ergostanol, chloroacetate, 1464³.
- C₁₁H₁₅NO p-Isocucotoluide, 1629⁸.
- C₁₁H₁₅O₄ Ac deriv. of alcohol from bark, 599⁸.
- Ergostanol, acetate, 1464³.
- Sitosterol, Ac deriv., 749⁷.
- Sitosterol, dihydro-, acetate, 101¹.
- C₁₁H₁₅O₁₁ Mellezitose, hendecamethyl-, 392⁴.
- C₁₁H₁₅O₄ 1,1' - Bi[anthraquinone] - 2,2' - dialdehyde, P 2478³.
- C₁₁H₁₅Br₂N₂O₄ Indoxyl - 2,2' - pseudoindoxyl, 1 - benzoyl - 5,7,5',7' - tetrahydro-2'-hydroxy-1'-nitroso-3-benzoate, 89⁷.
- C₁₁H₁₅Br₂Cl₄ 9,9'-Bianthryl, 10,10'-bis(bromomethylene) - 1,5,1',5' - tetrachloro-9,10,9',10'-tetrahydro-, 1260⁷.
- C₁₁H₁₅Br₂N₂O₄ 2,2'-Biindoxyl, 5,7,5',7'-tetrahydro-, dibenzoate, 89⁷.
- C₁₁H₁₅N₂O₄ Indigotin, 1,1'-bis(p-nitrobenzoyl)-, 89⁷.

- C₃₀H₁₇ClN₂O₃ Compd. from indigotin and BzCl, 87².
- C₃₀H₁₅Cl₂ Anthracene, 9,9'-acetylenebis[1,5-dichloro-9,10-dihydro-, 1260⁴.
Anthracene, 9,9'-ethylenebis[1,5-dichloro-(?), 1260⁴.
9,9' - Bianthryl, 1,5,1',5' - tetrachloro-9,10,9',10' - tetrahydro - 10,10' - dimethylene-(?), 1260⁴.
- C₃₀H₁₅Cl₂O Ether, bis(1,5-dichloro-9-anthrylmethyl), 1261¹.
- C₃₀H₁₅N₂O₄ Indigotin, 1,1'-dibenzoyl-, 87².
- C₃₀H₁₅O₁₂ 1,4,8,11 - Dibenzanthracenetetracarboxylic acid, 5,7,12,14-tetrahydro-, 6,7,12,14-tetraketo-, tetra-Me ester, 1458⁹.
- C₃₀H₁₅N₂O₄ 16a(16) - αγ' - Tribenzophenazinol, 11-nitro-16-phenyl-, 1988⁷.
- C₃₀H₁₅N₂O₇ Compd., m. 158°, from dibenzoyl indigo white and N₂O₅, 88⁷.
- C₃₀H₂₀ Anthracene, 9-(1-naphthyl)-10-phenyl-, 3191⁸.
- C₃₀H₂₀CuN₂O₈ Chalcone, β-hydroxy-4(or 4')-nitro-, Cu deriv., 81⁷.
- C₃₀H₂₀N₂ Biquinoline, 2,2'-diphenyl-(?), and salts, 914^{4,5}.
- C₃₀H₂₀N₂O₄ Indirubin white, dibenzoate, 89².
- C₃₀H₂₀N₂O₅ Anthraquinone, 2,7-dinitro-, dimethylanthracene addn. compd., 1116³.
- C₃₀H₂₀N₂O 3-Quinolol, 2-phenyl-4-(2-phenyl-3-quinolylazo)-, 2474⁴.
- C₃₀H₂₀N₂S₄ Disulfide, bis(2-phenylazothiono-3-indolecarboxyl)-, 1460¹.
- C₃₀H₂₀O₁₀P₂ o-Phenylene orthophosphate, 2461⁷, 3057².
- C₃₀H₂₁N₂O₉ 2 - (2,4 - Cresyl)-4,6-diphenylpyrylium picrate, 410⁸.
- C₃₀H₂₁N₂O₁₀ 2 - (2,4 - Cresyl) - 4 - phenyl-6-salicylpyrylium picrate, 410⁸.
- C₃₀H₂₂ClN₃ 6 - Amino - 1,2,3 - triphenyl-5,6-benzoquinoxalium chloride, 1987⁹.
- C₃₀H₂₂ClN₃O₄ 6 - Amino-1,2,3-triphenyl-5,6-benzoquinoxalium perchlorate, 1987⁹.
- C₃₀H₂₂N₂ Quinoxaline, 3,4-bis[2(or 7)-methyl-1-naphthyl]-, 1645⁸.
- C₃₀H₂₂N₂O₅ 5 - Acetamido-12-nitro 7 phenyl-αγ'-dibenzophenazonium acetate, 1988¹.
- C₃₀H₂₂N₂O₉ Pyridine, 2-(2,4-cresyl)-4 p-phenyl-6-salicyl-, picrate, 410⁸.
- C₃₀H₂₂N₂ 2,2'-Bimidazole, 4,5,4',5' tetra-kis(phenylazo)-, 3364¹.
- C₃₀H₂₂O 9-Anthrol, 9,10-dihydro-9-(1-naphthyl)-10-phenyl-, 3191⁸.
- C₃₀H₂₂O₂ Chalcone, α,α'-thiobis-, 2885⁵.
- C₃₀H₂₂O₃ 9,9' - Bi[xanthene] - 9,9' - dicarboxylic acid, di-Me ester, 3055⁴.
Sinomenol, di-Bz deriv., 1656¹.
- C₃₀H₂₂O₇ Trianhydrobisbenzoylacetalddehyde-phloroglucinol, 3620⁸.
- C₃₀H₂₂O₈ 5,7,12,14 - Dibenzanthracenetetrol, tetraacetate, 1458⁹.
- C₃₀H₂₂O₉ Vanillic anhydride, dibenzoate, 93⁴.
- C₃₀H₂₂ClN₂O₂ 5,12 - Diacetamido - 7 - phenyl-αγ'-dibenzophenazonium chloride, 1988¹.
- C₃₀H₂₂N₂ Triphenylamine, ar, ar'-diphenyl-, 68¹.
- C₃₀H₂₄N₂O₂ Acetanilide, o-[α - [α (o-formylphenylimino) - o - tolylimino] o-tolyliminomethyl]-, and -HCl, 76³.
- C₃₀H₂₄N₂O₃ 5 - Acetamido - 12 - amino - 7 - phenyl - αγ' - dibenzophenazonium acetate, 1988¹.
- C₃₀H₂₄O₇ Shikonin, dibenzoate, 2905¹.
- C₃₀H₂₄O₈ Me ester, m. 200°, of compd. from p - hydroxybenzaldehyde, Ac₂O and AcONa, 1257⁹.
- C₃₀H₂₅ClO₄ 1(2) - Benzofuranone, 4-chloro-2,2-bis(1,2 - dihydro - 2 - keto - 3,5 - dimethyl - 1 - benzofuryl) - 3,5 - dimethyl-, 407².
- C₃₀H₂₅O₄P Phenyl orthophosphate, 2461⁷, 3057².
- C₃₀H₂₆ 1,3-Butadiene, 1,4-diphenyl-1,4-di-p-tolyl-, 909⁴.
- C₃₀H₂₆N₂O Quinoline, 2-dibenzylamino-8-methoxy-3-phenyl-, 377².
- C₃₀H₂₆N₂O₄ Indole, 3,3'-piperonylidenebis-[1-acetyl-2-methyl-, 1118².
- C₃₀H₂₆N₂O₇S₂ 2-Naphtholdisulfonic acid, naphthylamine salt, 1646⁴.
- C₃₀H₂₆N₂O₈S₂ 2,2' - Stilbenedisulfonic acid, 4,4'-diacetamido-, di-Ph ester, 909³.
- C₃₀H₂₆O₂ 1,3-Butadiene, 1,4-di-p-anisyl-1,4-diphenyl-, 909⁴.
- C₃₀H₂₆O₄ 3-Hexine-1,2,5,6-tetrol, 1,2,5,6-tetraphenyl-, 1631¹.
- C₃₀H₂₆O₅ 1(2)-Benzofuranone, 2,2-bis(1,2-dihydro - 2 - keto - 3,5 - dimethyl-1-benzofuryl)-3,5-dimethyl-, 407².
- C₃₀H₂₆O₁₀ Δ⁽²⁾.α - Furanacetic acid, α,4-bis-(3,4 - dimethoxyphenyl) - 3 - hydroxy-5-keto-, Me ester, benzoate, 1110⁹.
- C₃₀H₂₇N₂O₄ o-Toluidine, N-(o-aminobenzal)-α - [α - (p - nitrophenylimino)tolylimino]-, acetone addn. compd., 76³.
- C₃₀H₂₇N₂O₅ Benzanilide, N, N',2,3-butylenebis-, 1810².
- C₃₀H₂₇N₂O₆ Hydrocinnamanilide, α-(β-phenylalanylamino)-, picrate, 378².
- C₃₀H₂₇N₂O₁₄ Piperazine, 2,3-dimethyl-1,4-diphenyl-, dipicrate, 1810².
- C₃₀H₂₇O 8 - Benzopinacolol, p, p', p'', p'''-tetramethyl-, 579³.
- C₃₀H₂₇O₂S₂ Anisil, dibenzyl mercaptol, 2074⁴.
- C₃₀H₂₇O₃S₂ Ethylene sulfide, tetra-p-anisyl-, 2674².
- C₃₀H₂₇O₉ Gossypol, 2514³.
- C₃₀H₂₇O₁₄ Alizarin, monoglucotetraacetate, acetate, 2904².
- C₃₀H₂₇O₁₅ Carnicinic acid, tetraacetate, 1127⁷.
- C₃₀H₂₇N₂ Carbazole, 2,7-bis(p-dimethylaminobenzalmino)-, 3199³.
- C₃₀H₂₈ Squalene, 940⁷.
- C₃₀H₂₈B₂CuF₆N₆ + 2H₂O, 868².
- C₃₀H₂₈Cl₂CoN₆O₈ + 4H₂O, 2231⁹.
- C₃₀H₂₈Cl₂CuN₆O₈, 2232¹.
- C₃₀H₂₈Cl₂N₂ Aniline, (dichlorodiphenylethylene)-bis-, 2894¹.
- C₃₀H₂₈Cl₂N₂NI₂O₄ + 4H₂O, 2232¹.
- C₃₀H₂₈Cl₂O₄ Phthalide, 3,4,5,6-tetrachloro-2,2-bis(5-methoxycarvacryl)-, 1456⁴.
- C₃₀H₂₈CoI₂N₆ Addn. compd. of CoI₂ and pyridine, 1235¹.
- C₃₀H₂₈CuO₈ γ-Pentenic acid, α-acetyl-β-keto-δ-phenyl-, ethyl ester, copper deriv., 2901⁸.
- C₃₀H₂₈IN₂ Aniline, p, p'-(α,β-diiodo-α,β-diphenylethylene)bis-, tetraiodide, 2894¹.
- C₃₀H₂₈N₂O₂ o', o''' - Bibenzanilide, 5',5'''-bis-(dimethylamino)-, 3190³.
- C₃₀H₂₈N₂O₃ Compd., m. 189-90°, from N-(o-nitrobenzyl)-o-toluidine, 1119⁷.
- C₃₀H₂₈N₂O₄ 2,5 - Piperazinedione, 1,4-dimethyl-, addn. compd. with p-phenylacetophenol, 68⁴.
- C₃₀H₂₈N₂O₅ 2,5-Piperazinedione, 1,4-dimethyl-, addn. compd. with 4-phenylazoresorcinol, 68⁴.
- C₃₀H₂₈N₂O₁₅S₂ 2,7 - Naphthalenedisulfonic acid,

- 4,5 - dihydroxy - 3,6 bis(6 - nitrocarvacrylazo)-, 908³.
- C₂₀H₃₃N₃O₁₄** 2,3-Butanediamine, *N,N'*-di-*p*-tolyl-, dipicrate, 1809⁹.
- C₂₀H₂₃O₃** Benzopinacol, *o,o',o'',o'''*-tetramethyl-, 2266⁹.
- C₂₀H₂₃O₄** Benzopinacol, tetramethoxy-, *di*-perchlorate, 2894².
- Isophthalic acid, 4,6-bis(6-isopropyl-*m*-tolyl)-(?), 1458⁸.
- Terephthalic acid, 2,5-bis(6-isopropyl-*m*-tolyl)-(?), 1458⁸.
- C₂₀H₂₃O₂** Gossypol, 2514².
- C₂₀H₂₁N₃O₃** Butyric acid, γ -benzoyl- α -methylamino - β - phenyl-, Et ester, picrolonate, 906⁹.
- C₂₀H₂₇N₃O₄** Benzopinacol, *p,p''*-bis(dimethylamino)-, salts, 2894².
- C₂₀H₂₅AsO₄** Veratric acid, 5-hydroxy-, Me ester, arsenate, 1105².
- C₂₀H₂₃N** Pyrrole, 1-isoamyl-2,5-dimethyl-3-triphenylmethyl-, 243⁸.
- C₂₀H₂₁N₃O₁₂** Akuamine, Ac deriv., picrate, 3623⁴.
- C₂₀H₂₁N₃O₂** Camphor, 3,3'-(1,4-naphthylene-diimino)bis-, 2266².
- C₂₀H₂₁N₃O₃S** α -Toluenesulfonic acid, α -ethyl-, strychnine salt, 2673⁸.
- C₂₀H₂₁N₃O₃S** *o',o'''* - Bi - *p* - toluenesulfonamide, 5',5''' - bis(dimethylamino)-, 3190⁸.
- C₂₀H₂₁O₁₁** See *Picrotoxin*.
- C₂₀H₂₁I₂N₃S₂**, 3571¹.
- C₂₀H₂₁N₃O₃** Acetamide, α,α',α'' -nitritotris-[*N*-phenyl-, and -HCl], 1657⁷.
- C₂₀H₂₃N₃O₃** Carvacrol, 3,5-bis(6-nitrocarvacrylazo)-, 903⁸.
- Thymol, 2,6 bis(6 nitrocarvacrylazo) , 903⁸.
- C₂₀H₂₁N₃O₁₅** Capronitrile, β -keto- ϵ -1-piperidyl- α - (β - 1 - piperidylethyl) , dipicrate, 2271⁴.
- C₂₀H₂₃CoN₄** Isopyrrole, 3,4,5-trimethyl-2-(3,4,5 - trimethyl - 2 pyrrolmethylene)-, Co salt, 85².
- C₂₀H₂₁CuN₄** Isopyrrole, 3,4,5 trimethyl-2-(3,4,5 - trimethyl - 2 - pyrrolmethylene)-, Cu salt, 85².
- C₂₀H₂₁N₄Ni** Isopyrrole, 3,4,5-trimethyl 2-(3,4,5 - trimethyl - 2 - pyrrolmethylene)-, Ni salt, 85².
- C₂₀H₂₁N₄Zn** Isopyrrole, 3,4,5-trimethyl-2-(3,4,5 - trimethyl - 2 - pyrrolmethylene)-, Zn salt, 85².
- C₂₀H₁₉Br₂N₄** Aniline, dibromoacetylenetetraakis-[dimethyl-, tetrabromide, 2894².
- C₂₀H₂₁N₃O₁₄** *d*-Glucose, 6- β cellobiosido- β -, osazone, 1101⁸.
- d*-Glucose, 6- β -lactosido- β -, osazone, 1101⁸.
- C₂₀H₂₁N₃O₁₅** Adipic acid, α,δ -bis(diethylamino)-, di-Et ester, dipicrate, 60⁹.
- C₂₀H₂₃O₄** Anhydroquinovic acid, 2894⁴.
- Dehydroquinovic anhydride, 2894⁴.
- Novic acid, 2894².
- C₂₀H₂₃O₃** Dehydroquinovic acid, 2894⁴.
- C₂₀H₂₃O₂** Cymarine, 3902⁹.
- C₂₀H₂₃O₁₀** + 2.5H₂O, 2358⁴.
- C₂₀H₂₁BrO** Amyrenone, bromo-, 1272¹.
- C₂₀H₂₁NO** Stearalide, phenyl-, 1642².
- C₂₀H₂₃Br₂O₂** Allobetulone, dibromo-, 1659⁴.
- C₂₀H₂₁N₃O₁₄** Piperazine, 1,4-bis(η -aminoheptyl)-, dipicrate, 566⁹.
- C₂₀H₂₁NiO₃S** Camphor, : β -mercapto-, Ni deriv., 908².
- C₂₀H₂₁O₃** Quinovic acid, 2894².
- C₂₀H₂₃O₂** Hydrocymarin, 3902⁹.
- C₂₀H₂₃O₁₂** See *Ouabain*.
- C₂₀H₂₁BrO** Amyranone, bromo-, 1272¹.
- C₂₀H₂₃** Lupeylene, 2477⁴.
- C₂₀H₂₃Cl₂O₃S₂** Camphor, β -mercapto-, SnCl₂ compd., 908².
- C₂₀H₂₃O₂** Caryophyllene, 985².
- C₂₀H₂₃O₄** Oxidation product of rubber, 1901⁸.
- C₂₀H₂₃O₃** Methyl ester, m. 225°, of sapogenin from quillaic acid, 590¹.
- C₂₀H₂₃O₁₀** Oxidation product of rubber, 1901⁸.
- C₂₀H₂₃O₁₂** Ouabain, dihydro-, 3903⁹.
- C₂₀H₂₁NO₃** Oxime, m. 238°, of Me ester of sapogenin from quillaic acid, 590¹.
- C₂₀H₂₃N₃O₂** Semicarbazone, m. 288°, of sapogenin from quillaic acid, 590¹.
- C₂₀H₂₃** Spinacene, 1891³.
- Squalene, 1111⁸, 1891^{2,3}, 3033³.
- C₂₀H₂₃CrO₄** Compd., m. 116°, from β -isocaryophyllene alc. and CrO₃, 237⁸.
- C₂₀H₂₃O** Amyrin, 1271⁹.
- Ether, allyl cholesteryl, 1991³.
- Lupeol, 2477⁴.
- C₂₀H₂₃O₂** Betulinol, 1658⁸.
- Heterobetulin, 1659⁴.
- C₂₀H₂₃O₂** Oxidation product of rubber, 1901⁸.
- C₂₀H₂₁N₃O₂** Lauramide, *N,N'*-*p*-phenylenebis-, 2884⁴.
- C₂₀H₂₃O** Alnulin-like substance from bark, 599⁸.
- Ether, cholesteryl isopropyl, 1991⁴.
- C₂₀H₂₃Bi₂O₁₅** Valeric acid, Bi salt, 2359⁴.
- C₂₀H₂₃O** Carbinol, diisopropyl-norcholyl-, 248⁸.
- C₂₀H₂₃O₂** Pentadecenoic acid, pentadecenyl ester, 2874¹.
- C₂₀H₂₃O₂P** Menthyl phosphite, 1806².
- C₂₀H₂₃O₂P** Menthyl orthophosphate, 1806².
- C₂₀H₂₃O₁₁** 1,28-Octacosanedicarboxylic acid, 3182⁵.
- 1,24 - Tetracosanedicarboxylic acid, di-Et ester, 3182⁵.
- C₂₀H₁₉FeN₃Pb₄** Triethyllead ferrocyanide, 1443⁴.
- C₂₀H₂₃N₃P₃**, 870².
- C₂₀H₂₃** Hydrocarbon from mistletoe berries, 600⁴.
- Triacotane, 3598⁸.
- C₂₁H₁₉N₃** 4',5'-Di[1'(and 2')-phenyl-1',2',3'-triazolo] - 1,2,7,8 - acridine, 9-phenyl-, 2689⁹.
- C₂₁H₂₃N₃O** Xanthenobistriazole, 10,12-dihydro-2,10,12 triphenyl-, 2689⁴.
- C₂₁H₂₃O₂** 3,3' - Spiro[4,3- β -naphthopyran], 2-phenyl-, 408⁴.
- C₂₁H₂₃ClO₂** 3-[β - (2 - Hydroxy-1-naphthyl)- α -phenylvinyl] - β - naphthopyrylium chloride (?), salts, 408⁴.
- 3 - [β - (2 - Hydroxy - 1 - naphthyl)vinyl]-2-phenyl - β - naphthopyrylium chloride (?), salts, 408⁴.
- C₂₁H₂₃ClO₃** 3 - [β - (2 - Hydroxy-1-naphthyl)- α - phenylvinyl] - β - naphthopyrylium perchlorate (?), 408⁴.
- 3 - [β - (2 - Hydroxy-1-naphthyl)vinyl]-2-phenyl - β - naphthopyrylium perchlorate (?), 408⁴.
- C₂₁H₂₃N₇** 4',5' - Di[2' - phenyl - 1',2',3' - triazolo] - 1,2,7,8 - acridine - 9,10 - dihydride, 9-phenyl-, 2689⁹.
- C₂₁H₂₃N₃O₂** 2,1,3-Benzotriazol-5-ol, 4,4'-benzo[1,2-phenyl-, 2689⁴.
- C₂₁H₂₃N₃O₁₀** 2-*p*-Anisyl - 6 - (2,4 - cresyl) - 4-phenylpyrylium picrate, 410².
- C₂₁H₂₃N₃O₁₁** 2(and 4)-*p*-Anisyl-6(and 2)-(2-

- hydroxy - *p* - anisyl)-4 (and 6) - phenylpyrylium picrate, 410^a.
- C₂₁H₁₅O₃ 3,3' - Spirobi[4,3 - *β* - naphthopyran]-2,2'-dicarboxylic acid, di-Et ester, 3195^a.
- C₂₁H₁₅NO₃ Propionic acid, *β*-benzoyl-*β*-hydroxy-*α*-phenyl-, Me ester, oxime, dibenzoate, 583^a.
- C₂₁H₁₅ClNO₃ 2-*p*-Anisyl - 6 - (2,4 - cresyl)-1,4-diphenylpyridinium perchlorate, 410^a.
- C₂₁H₁₅ClNO₃ 2 (and 4)-*p*-Anisyl-6 (and 2)-(2-hydroxy - *p* - anisyl)-1,4 (and 1,6)-diphenylpyridinium perchlorate, 410^a.
- C₂₁H₁₅N₂O₃ Benzamide, *N*-[*p*-(*N*-phenethylbenzamidomethyl)phenethyl]-, 566^a.
- C₂₁H₁₅N₂O₃ Acetamide, *α*-benzamide-*N*-(*β*-hydroxy - *α*,*γ*,*γ'* - triphenylisobutyl)-, 568^a.
- C₂₁H₁₅N₂O₃ Carbanilide, *m*,*m'* - bis(*o*-phenetylcarbamyl)-, 1451^a.
- C₂₁H₁₅N₂S 2-Propanone, 1,3-diphenyl-, thio-carbohydrazone, 245^a.
- C₂₁H₁₅N₂O₄ 3-Pyrrolecarboxylic acid, 5,5'-diphenylmethylenebis[2,4 - dimethyl-, di-Et ester, 381^a.
- C₂₁H₁₅N₂O₄S Ethanesulfonic acid, 1-phenyl-, brucine salt, 2673^a.
- C₂₁H₁₅O₄ Thymol, 6,6'-benzalbisl-, diacetate, 1450^a.
- C₂₁H₁₅Cl₂N₂O₄ Emetamine, dimethiodide, 2699^a.
- C₂₁H₁₅N₂O₄ Pimelic acid, *α*,*η* - bis(diethylamino)-, di-Et ester, dipicrate, 607^a.
- C₂₁H₁₅O₄ Novic acid, methyl ester, 2894^a.
- C₂₁H₁₅O₄ Pyroquinovic acid, methyl ester, 2894^a.
- C₂₁H₁₅O₄ Pyroquinovic acid, acetyl deriv., 2894^a.
- C₂₁H₁₅O₅ Oleandrin, 299^a.
- C₂₁H₁₅O₅ Lupeol, formate, 2477^a.
- C₂₁H₁₅O₅ Heterobetulin, monoformate, 1659^a.
- C₂₁H₁₅O₅ Hederagenin, 915^a.
- Oxidation product of rubber, 1901^a.
- C₂₁H₁₅O₅ Fatsin, 3631^a.
- C₂₁H₁₅O₅ Ether, butyl cholesteryl, 1991^a.
- C₂₁H₁₅O₅ Ether, cholesteryl isobutyl, 1991^a.
- C₂₁H₁₅ClNO₅ Hentriacontane, 16-chloro-16-nitroso-, 2872^a.
- C₂₁H₁₅N₂O₅ Chrysene, 2,7-dinitroanthraquinone addn. compd., 1116^a.
- C₂₁H₁₅N₂ Dibenzofluorindine, phenyl-, 2272^a.
- C₂₁H₁₅N₂O 5 - Iso - *γ*,*γ'* - dibenzophenoxazine, 9-anilino-5-phenylimino-, 1124^a.
- C₂₁H₁₅CuO₅ Chalcone, *β*-hydroxy-4 (or 4')-(3,4-methylenedioxy)-, Cu deriv., 81^a.
- C₂₁H₁₅N₂O₅ Indigotin, 1,1'-dibenzoyl-5,5'-dimethyl-, 89^a.
- C₂₁H₁₅N₂O₅ Anthraquinone, 1,3,6,8-tetramethyl-, 2,7-dinitroanthraquinone addn. compd., 1116^a.
- C₂₁H₁₅O₅ 3,3' - Spirobi[4,3-*β*-naphthopyran], 2-benzyl-, 2900^a.
- C₂₁H₁₅Cl Anthracene, 9-chloro-9,10-dihydro-9,10,10-triphenyl-, 1648^a.
- C₂₁H₁₅ClO₅ 3 - [β-(2-Hydroxy-1-naphthyl)-vinyl]-2-benzyl - *β* - naphthopyrylium perchlorate, 2900^a.
- C₂₁H₁₅NO₅ Atropine, CaO₃ addn. compd., 735^a.
- C₂₁H₁₅N₂O₅ Indoxyl - 2,2' - pseudindoxyl, 1-benzoyl - 2' - hydroxy - 7,7' - dimethyl-1'-nitroso-, 3-benzoate, 89^a.
- C₂₁H₁₅Br₂CoN₂ 2-Naphthylamine, 1-(*p*-bromophenylazo)-, Co compd., 1810^a.
- C₂₁H₁₅Br₂Ni 2-Naphthylamine, 1-(*p*-bromophenylazo)-, Ni compd., 1810^a.
- C₂₁H₁₅Cl₂N₂O 6 - Acetamido - 1,2,8 - triphenyl-5,6-benzoquinoxalinium chloride, 1988^a.
- C₂₁H₁₅Cl₂N₂O₃ 6 - Acetamido-1,2,3-triphenyl-5,6 - benzoquinoxalinium perchlorate, 1988^a.
- C₂₁H₁₅Cl₂CoN₂ 2-Naphthylamine, 1-(*p*-chlorophenylazo)-, Co compd., 1810^a.
- C₂₁H₁₅Cl₂NiN₂ 2-Naphthylamine, 1-(*p*-chlorophenylazo)-, Ni compd., 1810^a.
- C₂₁H₁₅CoN₂O₂ 2-Naphthol, phenylazo-, Co complex compd., 1457^a.
- C₂₁H₁₅CuN₂O₂ 2-Naphthol, phenylazo-, Cu complex compd., 1456^a.
- C₂₁H₁₅N₂O₂ Diimide, *α*-(*p*-phenylbenzoyl)-*β*-triphenylmethyl-, 1455^a.
- C₂₁H₁₅N₂O₂ 2,2'-Biindoxyl, 5,5' (and 7,7')-dimethyl-, dibenzoates, 89^a.
- C₂₁H₁₅N₂O₂ Ethoxy compd., m. 249°, from indigotin, 88^a.
- C₂₁H₁₅N₂O₂ Retene, 2,7-dinitroanthraquinone addn. compd., 1116^a.
- C₂₁H₁₅N₂IO₂ 2-Naphthol, phenylazo-, Ni complex compd., 1456^a.
- C₂₁H₁₅N₂O₂ Pyrazine, dibenzoyldihydro-2,5-dimethyl-3,6-bis(*o*-nitrophenyl)-, 76^a.
- C₂₁H₁₅N₂O₂ Benzohydrylamine, *N*-diphenylmethylene-, picrate, 3052^a.
- C₂₁H₁₅N₂O₂S See Congo red.
- C₂₁H₁₅N₂IO₂S Naphthalenedisulfonic acid, (sulfohiphenylenedisazo)bis[amino-, Na salt, 1678^a.
- C₂₁H₁₅O Acetophenone, *p*,*α*,*α*-tetraphenyl-, 1455^a.
- C₂₁H₁₅O₂ Quinone, 2,5-dibenzyl-3,6-diphenyl-, 1804^a.
- C₂₁H₁₅O₂ 3-Pentadienone, 1-(4-hydroxy-*m*-anisyl)-5-salicyl-, dibenzoate, 3809^a.
- C₂₁H₁₅BiO₂ Bismuthine, triphenyl-, dibenzoate, 1252^a.
- C₂₁H₁₅ClN₂O₂ Dibenzocopyrine, 6-(chlorophenyl) - 2,3,10,11 - tetramethoxy-7-phenyl-, and -HCl, 81^a, 82^a.
- C₂₁H₁₅N₂O₂ Dibenzocopyrine, 2,3,10,11-tetramethoxy - 6 - (nitrophenyl)-7-phenyl-, and -HCl, 82^a.
- C₂₁H₁₅N₂O₂ 2,4-Di-*p*-anisyl - 6 - (2 - hydroxy-*p*-anisyl)pyrylium picrate, 410^a.
- C₂₁H₁₅N₂O₂ 4-*p*-Anisyl - 2,6 - bis(2 - hydroxy-*p*-anisyl)pyrylium picrate, 410^a.
- C₂₁H₁₅O₂Stb Stibine, triphenyl-, dibenzoate, 1252^a.
- C₂₁H₁₅ Ethane, pentaphenyl-, 1455^a.
- C₂₁H₁₅CoN₂ 2-Naphthylamine, phenylazo-, Co complex compd., 1457^a, 1810^a.
- C₂₁H₁₅CuN₂ 2-Naphthylamine, phenylazo-, Cu complex compd., 1456^a.
- C₂₁H₁₅CuO₂ Chalcone, *β*-hydroxymethoxy-, Cu deriv., 81^a.
- C₂₁H₁₅N₂O Benzoic acid, *p*-phenyl-, triphenyl-methylhydrazide, 1455^a.
- C₂₁H₁₅N₂O₂ 5,12 - Diacetamido - 7 - phenyl-*α*,*γ*' - dibenzophenazonium acetate, 1988^a.
- C₂₁H₁₅NiN₂ 2-Naphthylamine, phenylazo-, Ni complex compd., 1456^a, 1810^a.
- C₂₁H₁₅N₂O₂ *o*-Toluidine, *N*-(*o*-amino-benzal)-*α* - [α - (*p* - nitrophenylimino)tolylimino]-, pyridine addn. compd., 76^a.
- C₂₁H₁₅O Carbinol, (*α*,*α*-diphenyl-*o*-tolyl)-phenyl-, 1648^a.
- C₂₁H₁₅O₂ Hydroquinone, 2,5-dibenzyl-3,6-diphenyl-, 1804^a.
- C₂₁H₁₅O₂ Biphenyl, *p*,*p'*-bis(4-hydroxy-3-methoxy-cinnamyl)-, 2272^a.

- C₂₂H₂₁O₁₀S₂** Biphenyl, *p,p'*-bis(4-hydroxy-3-methoxy-5-sulfocinnamyl)-, 2272⁹.
C₂₂H₂₁Cl₄O₅ Scoparin, pentakis(chloroacetate), 575⁴.
C₂₂H₂₁ Butatriene, 1,1,4,4-tetra-*p*-tolyl-, 2267⁷. Indene, 1 - (di-*p*-tolylmethylene)-6-methyl-3-*p*-tolyl-, 2267⁷.
C₂₂H₂₁ClNO₃ 2,4-Di-*p*-anisyl-6-(2-hydroxy-*p*-anisyl)-1-phenylpyridinium perchlorate, 410⁸.
C₂₂H₂₁N₂O₅S₂ 1-Naphthol-4-sulfonic acid, benzidine salt, 3361⁹.
C₂₂H₂₁O₄ Cyclobutane, 1,2-di-*p*-anisyl-3,4-dibenzoyl-, 397⁸.
C₂₂H₂₁NO₃ Ketone, 2,3-di-*p*-anisyl-4-(α -iminobenzyl)cyclobutyl phenyl, 397⁸.
C₂₂H₂₁NO₄ Cyclobutane, 1,2-di-*p*-anisyl-3,4-dibenzoyl-, oxime, 397⁸.
C₂₂H₂₁Br₂ Butane, 2,2,3,3-tetrabromo-1,1,4,4-tetra-*p*-tolyl-, 2267⁷.
C₂₂H₂₁Br₄ Butane, 2,2,3,3-tetrabromo-1,1,4,4-tetra-*p*-tolyl-, 2267⁷.
C₂₂H₂₁Cl₂ 2-Butene, 2,3-dichloro-1,1,4,4-tetra-*p*-tolyl-, 2267⁷.
C₂₂H₂₁Cl₄ Butane, 2,2,3,3-tetrachloro-1,1,4,4-tetra-*p*-tolyl-, 2267⁷.
C₂₂H₂₁Cl₄O₄ Thymolphthalein, tetrachloro-, diacetate, 1450⁸.
C₂₂H₂₁CuO₅ γ,ϵ -Heptadienic acid, α -acetyl- β -keto- ϵ -phenyl-, Me ester, Cu deriv., 2468⁸.
C₂₂H₂₁HgN₂O₄ *p,p'*-Biacetanilide, 3,3'-mercuribis-, 2255⁸.
C₂₂H₂₁N₂O₅ Croosol, α,α -bis(1-acetyl-2-methyl-3-indyl)-, acetate, 1118².
C₂₂H₂₁N₂O₅S Quinazoline, 2,2'-thiobis[4-ethoxy-3,4-dihydro-3-phenyl-, 587⁷.
C₂₂H₂₁N₂O₅ Salicylic acid, 5-phenylazo-, addn. compd. with 1,4-dimethyl-2,5-piperazine-dione, 68⁸.
C₂₂H₂₁O₄ 1(2)-Benzofuranone, 2,2-bis(1,2-dihydro-2-keto-3,5-dimethyl-1-benzofuryl)-3-isopropyl-6-methyl-, 407².
C₂₂H₂₁NO₁₁ 1,2-Benzacridine-7-carboxylic acid, 5,6-dihydro-, tetraacetylglucoside, 1122⁹.
C₂₂H₂₁N₄ $\Delta^{1,4}$ -1-Hexadienone, 5- β -phenylhydrazino-1,3-di-*p*-tolyl-, phenylhydrazone, 1814¹.
 2-Picoline, 1-anilino-1,2-dihydro-2- β -phenylhydrazino-4,6-di-*p*-tolyl-, 1814¹.
C₂₂H₂₁N₂O₅ Cyclobutane, 1,2-di-*p*-anisyl-3,4-dibenzoyl-, dihydrazone, 397⁸.
C₂₂H₂₁N₂O₁₁ Piperazine, 2,3-dimethyl-1,4-di-*p*-tolyl-, dipicrate, 1809⁹.
C₂₂H₂₁O₄ Bi[naphthalene]dione, dicyclohexyl-, 1114⁴.
 2-Butene, 1,4-diethoxy-1,1,4,4-tetra-phenyl-, 2459⁸.
C₂₂H₂₁O₂ 4,4'-Bi-1-naphthol, 2,2'-dicyclohexyl-, 1114⁴.
C₂₂H₂₁O₄ 1-Butanol, 2,2'-oxybis[1,1-diphenyl-, 2459⁸.
C₂₂H₂₁N₂O₅ Camphor, 3,3'-*p*-biphenylenediminobis-, 2266¹.
C₂₂H₂₁N₂O₅ Benzylhydroxymethylphenylammonium tartrate, 65⁸.
C₂₂H₂₁N₂O₅ Akuamine, picrolonate, 3623².
C₂₂H₂₁ Hydrocarbon, m. 233°, from Et etiocholanate, 591⁸.
C₂₂H₂₁N₂O₁₁ Adipic acid, α,ϵ -di-1-piperidyl-, di-Et ester, dipicrate, 59⁸.
C₂₂H₂₁N₂O₁₂ Suberic acid, α,ϵ -bis(diethylamino)-, di-Et ester, dipicrate, 60⁸.
C₂₂H₂₁O₅ Quinovic acid, acetyl deriv., 2894².
C₂₂H₂₁Co₂N₂O₁₀S₂ + 12H₂O, 868⁸.
C₂₂H₂₁N₂O₂ *p,p'*-Bicapanilide, 2884⁸.
C₂₂H₂₁N₂O₂ Piperazine, 1,4-bis(η -benzamidoheptyl)-, and *di-HCl*, 569⁹.
C₂₂H₂₁N₂O₃ Githagenin, diacetate, 384².
C₂₂H₂₁NO₃ See *Veratrine*.
C₂₂H₂₁Hg₂O₈ Compd., m. 188°, from caryophyllene, 236⁸.
C₂₂H₂₁NO₁₁ See *Protoveratrine*.
C₂₂H₂₁O Protalnullin, 599⁹.
C₂₂H₂₁O₂ Lupeol, acetate, 2477⁸.
C₂₂H₂₁O₂ Ac deriv. of substance from bark, 599⁸.
C₂₂H₂₁O₂ Sapogenin, 3631⁴.
C₂₂H₂₁N₂O₂ Trileucoamide, *N,N'*-*p*-phenylenebis-, 2884⁸.
C₂₂H₂₁O Ether, cholesteryl isoamyl, 1991⁴.
C₂₂H₂₁NO₃ Codeine, C₂₁H₂₁ addn. compd., 735⁸.
C₂₂H₂₁N₂O₂ Pyrogallol, 4-phenylazo-, tribenzoate, 3050⁸.
C₂₂H₂₁N₂O₇ Pyrogallol, 4-phenylazoxy-, tribenzoate, 3050⁸.
C₂₂H₂₁ClO₇ 3-[β -(2-Hydroxy-1-naphthyl)- α -phenylvinyl]- β -naphthopyrylium perchlorate (?), acetate, 408⁸.
 3-[β -(2-Hydroxy-1-naphthyl)vinyl]-2-phenyl- β -naphthopyrylium perchlorate (?), acetate, 408⁸.
C₂₂H₂₁MnN₂O₁₅ 540⁴.
C₂₂H₂₁O₂ Anthrone, 9-hydroxy-9-triphenylmethyl-, 1115⁵.
C₂₂H₂₁O₆ Isoflavone, 5,7-dihydroxy-4'-methoxy-2-styryl-, cinnamate, 246⁸.
C₂₂H₂₁N₇ 4',5'-Di[2'-*p*-tolyl-1',2',3'-triazolo]-1,2,7,8-acridine-9,10-dihydride, 9-phenyl-, 2889⁹.
C₂₂H₂₁N₂O Diimide, α -diphenylacetyl- β -triphenylmethyl-, 1455⁷.
C₂₂H₂₁N₂O₄ Dibenzocopyrine, 2,3,10,11-tetramethoxy-6-(3,4-methylenedioxyphenyl)-7-phenyl-, 81⁹.
C₂₂H₂₁O 2-Propanone, pentaphenyl-, 1455⁷.
C₂₂H₂₁O₇ 3-Pentadienone, 1,5-bis(4-hydroxy-m-anisyl)-, dibenzoate, 3609⁴.
C₂₂H₂₁O₈ Arabinose, tetra-benzoyl-, 2120⁸, 2121¹.
C₂₂H₂₁N₂O Aniline, *p*-(α,γ -diphenyl- γ -1-naphthylpropadienyl)-*N,N*-dimethyl-, isomers, 909⁹.
C₂₂H₂₁N₂O Acetic acid, diphenyl-, triphenylmethylhydrazide, 1455⁷.
C₂₂H₂₁N₂O Dibenzocopyrine, 6-anisyl-2,3,10,11-tetramethoxy-7-phenyl-, and *HCl*, 81⁹.
C₂₂H₂₁N₂O Carbanilide, *m,m'*-bis[(*p*-carboxyphenyl)carbamyl]-, di-Et ester, 1451⁷.
C₂₂H₂₁O 4-Pentadienone, 1,5-bis(4-benzyloxy-m-anisyl)-, 3612².
C₂₂H₂₁ClFeN₂O₄ Hemin, 3060⁴.
C₂₂H₂₁FeN₂O₄ Hematin, 3060⁴.
C₂₂H₂₁N₂O₄ See *Ergotamine*.
C₂₂H₂₁N₂O₄ α -Glucoseptose, benzylphenyl-, osazone, 2879⁹.
C₂₂H₂₁Hg₂O Compd., m. 154°, from caryophyllene, 236⁸.
C₂₂H₂₁N₂O₄ Hematoporphyrin, 3060⁴.
C₂₂H₂₁O Pyroquinovic acid, diacetyl deriv., 2894².
C₂₂H₂₁O Diacetate, m. 250°, of sapogenin from quillaic acid, 591⁸.
C₂₂H₂₁BrO₂ Bromo deriv., m. 265°, of compd. from *Asclepias syriaca*, 1271⁸.
C₂₂H₂₁O Phytosterolin, 3293⁴.

- C₃₃H₅₈O** Ether, cholesteryl hexyl, 1991⁴.
C₃₃H₅₈O₂ Alniviridol, 599⁹.
C₃₃H₅₈O₂ Isoviolanthrone, P 250⁴, 2894⁴.
C₃₃H₅₈Br₂O₂ Fluorescein, dibromo-, dibenzoate, 1983⁴.
C₃₃H₅₈N₂O₂ 5, 7, 12, 14 - Dibenzanthracene-tetrone, dianilino-, 1458⁹.
C₃₃H₅₈O₃ Δ^{1,2'} - Bi[indan] - 3, 1', 3' - trione, 2-α-1,3-diketo - 2 - indanylbenzyl-, 3202⁹.
C₃₃H₅₈N₂O₃ Anthraquinone, 2, 7-dinitro-, di-2-naphthylamine addn. compd., 1116⁴.
C₃₃H₅₈ 11, 11' - Bichrysofluorene, 239⁴, 581⁷.
aa' - Dibenzofluorene, 13-(9-fluoryl)-, 239⁴, 581⁷.
C₃₃H₅₈N₂ 1, 2-Benzofluorindine, 7, 14-diphenyl-, 2272⁴.
 Isopnaphthophenofluorindine, *N*-diphenyl-, 2272⁴.
C₃₃H₅₈CuN₂O₂ 2-Naphthol, *p*-tolylazo-, Cu complex compd., 1459⁹.
C₃₃H₅₈N₂NiO₂ 2-Naphthol, *p*-tolylazo-, Ni complex compd., 1457⁴.
C₃₃H₅₈N₂O₃ Anthranilaldehyde, *N*-[o-[o-(aminobenzalamino)benzalaminobenzal]-, *p*-nitroaniline addn. compd., 76⁹.
C₃₃H₅₈N₂O₃S See *Benzopurpurin*.
C₃₃H₅₈N₂O₃S₂ 1-Naphthol-3, 6-disulfonic acid, 2, 2' - (3, 3' - dimethyl - *p* - biphenylene-disazo)bis[8-amino-, *Na* salt, 1678⁹.
C₃₃H₅₈CoN₂ 2 Naphthylamine, 1-*o*(*m* and *p*)-tolylazo-, Co compd., 1810⁷.
C₃₃H₅₈CuN₂ 2-Naphthylamine, *o*-tolylazo-, Cu complex compd., 1459⁹.
C₃₃H₅₈CuO₂ Chalcone, β-hydroxy-4(or 4')-methoxy-α-methyl-, Cu deriv., 81⁴.
C₃₃H₅₈CuO₂ Chalcone, β-hydroxy-3, 4'(or 4, 3')-dimethoxy-, Cu deriv., 81⁴.
C₃₃H₅₈N₂O₂ Dibenzocopyrine, 6-*m*-anisyl-7-*p*-anisyl - 2, 3, 10, 11 - tetramethoxy-, 82⁴.
 Dibenzocopyrine, 6 - (dimethoxyphenyl)-2, 3, 10, 11 - tetramethoxy-7-phenyl-, and -HCl, 82⁴.
C₃₃H₅₈N₂Ni 2-Naphthylamine, 1-*o*(*m* and *p*)-tolylazo-, Ni compd., 1810⁷.
C₃₃H₅₈O₂ Biantnone, hexamethoxy-, 2895¹.
C₃₃H₅₈O₂ Hydroquinone, 2, 5-bis(3, 4, 5-trihydroxyphenyl)-, octaacetate, 2687⁴.
C₃₃H₅₈N₂O₂S 1-Naphthol-4-sulfonic acid, tolidine salt, 3361⁹.
C₃₃H₅₈N₂O₂S₂ 1-Naphthol-4-sulfonic acid, bianisidine salt, 331⁹.
C₃₃H₅₈N₂O₂ Porphyrin from hematin, 2481¹.
C₃₃H₅₈Br₂N₂O₂ Porphyrin from hematin, 2481¹.
C₃₃H₅₈O₂S Ethylene sulfide, tetra-*p*-phenetyl-, 2674⁴.
C₃₃H₅₈CuO₂ Capric acid, β-benzoyl-γ-hydroxy-α-keto-, lactone, Cu deriv., 3900⁹.
C₃₃H₅₈N₂O₂ Piperazine, 1, 4-bis[*p*-(β-aminoethyl)benzyl]-, dipicrate, 566⁹.
O₂H₅₈Cl₂N₂ Aniline, dichloroacetylenetetraakis(dimethyl-, 2893⁹.
C₃₃H₅₈N₂ Aniline, diiodoacetylenetetraakis(dimethyl-, *tetraiodide*, 2894⁴.
C₃₃H₅₈N₂O₂ Camphor, 3, 3'-(3, 3'-dimethyl-*p*-biphenylene)diminobis-, 2266⁴.
C₃₃H₅₈N₂O₂ Benzylethylhydroxyphenylammonium tartrate, 65⁹.
 Benzylethoxyethyl-*p*-tolylammonium tartrate, 66⁴.
C₃₃H₅₈CoN₂O₂ 5 - Isopyrrolecarboxylic acid, 3, 5-dimethyl - 2 - (3, 4, 5 - trimethyl-2-pyrrolylmethylene)-, Et ester, Co salt, 85⁹.
C₃₃H₅₈CuN₂O₂ 5 - Isopyrrolecarboxylic acid, 3, 5 - dimethyl - 2 - (3, 4, 5 - trimethyl-2-pyrrolylmethylene)-, Et ester, Cu salt, 85⁹.
C₃₃H₅₈N₂NiO₂ 5-Isopyrrolecarboxylic acid, 3, 5 - dimethyl - 2 - (3, 4, 5 - trimethyl-2-pyrrolylmethylene)-, Et ester, Ni salt, 85⁹.
C₃₃H₅₈N₂O₂ Benzopinacol, tetrakis(dimethylamino)-, and *dipchlorate*, 2893⁹.
C₃₃H₅₈N₂O₂Zn 5-Isopyrrolecarboxylic acid, 3, 5 - dimethyl - 2 - (3, 4, 5 - trimethyl-2-pyrrolylmethylene)-, Et ester, Zn salt, 85⁹.
C₃₃H₅₈N₂O₂ 3-Pyrrolecarboxylic acid, 5, 5', 5'', - 5''' - acetylenetetraakis[2 - methyl-, tetra-Et ester, 381⁷.
C₃₃H₅₈O₂ Xanthorhammin, 1267².
C₃₃H₅₈ Hydrocarbon, *m*. 175-6°, from bis-norcholylidiphenylcarbinol, 591².
C₃₃H₅₈Br₂N₂O₂S₂ Camphorsulfonic acid, *α*, *α*-bromo, 2, 2'-bis-*m*-toluidi
C₃₃H₅₈CoN₂ Isop
 3, 5 - dimethyl-2-(4-ethyl-2-pyrrolylmethylene)-3, 5-dimethyl-, Co deriv., 2701⁹.
C₃₃H₅₈CuN₂ Isopyrrole, 4-ethyl-2-dimethyl-2-pyrrolylmethylene-, Cu deriv., 2701⁹.
C₃₃H₅₈N₂Ni Isopyrrole, 4-ethyl-2-(4-ethyl-3, 5-dimethyl - 2 - pyrrolylmethylene)-3, 5-dimethyl-, Ni deriv., 2701⁹.
C₃₃H₅₈N₂Zn Isopyrrole, 4-ethyl-2-(4-ethyl-3, 5 - dimethyl - 2 - pyrrolylmethylene)-3, 5-dimethyl-, Zn deriv., 2701⁹.
C₃₃H₅₈O₂ Diphenic acid, 3191¹.
C₃₃H₅₈N₂O₂ See *Acetone*.
C₃₃H₅₈ Hydrocarbon from marine animal oils, 1801⁴.
C₃₃H₅₈N₂O₂ *p*, *p*'-Biundecylamide, 2884⁹.
C₃₃H₅₈O₂ Ergostanol, benzoate, 1464⁴.
C₃₃H₅₈O₂ Heterobetulin, diacetate, 1650⁴.
C₃₃H₅₈O₂ Githagin, 384⁹.
C₃₃H₅₈N₂O₂ Myristamide, *N*, *N*'-*p*-phenylene-bis, 2884⁹.
C₃₃H₅₈O Ether, cholesteryl heptyl, 1991⁴.
C₃₃H₅₈O₂ 1, 32 - Dotriacontanedicarboxylic acid, 3900⁹.
 1, 28-Octacosanedicarboxylic acid, di-Et ester, 3911⁴, 3182⁴.
C₃₃H₅₈ Compd from oleander leaves, 939⁹.
C₃₃H₅₈N₂O₂ 1, 4-Imidazopyridin-2-ol, 3, 3'-benzalbis, dibenzoate, 1264⁹.
C₃₃H₅₈O₂ 5, 7, 12, 14-Dibenzanthracenetetrol, triacetate, benzoate, 1458⁹.
C₃₃H₅₈ClN₂ 14 - Methyl - 7, 9 - diphenyl - 1, 2-benzofluorindinium chloride, 2272⁴.
C₃₃H₅₈N₂O₂ Glyoxylohydroxamamide, *N*-benzoyl-α phenyl, oxime, di-Bz deriv., 1098⁹.
C₃₃H₅₈N₂O₂ 2, 1, 3 - Benzotriazol-5-ol, 4, 4'-benzalbis[2-phenyl-, diacetate, 2689⁹.
C₃₃H₅₈N₂ Pyrrole, 2, 5-diphenyl 3-triphenylmethyl-, 243⁹.
C₃₃H₅₈N₂O₂ Carbocyanine, 1, 1'-dimethyl-β-phenyl-, picrate, 412⁹.
C₃₃H₅₈N₂O₂ Anthranilaldehyde, *N*-[o-[o-(aminobenzalamino)benzalaminobenzal]-, benzoylhydrazone, 76⁹.
C₃₃H₅₈O₂ *o*-Cresol, 4, 4'-benzalbis-, dibenzoate, 1645⁹.
C₃₃H₅₈O₂ *o*-Cresolbenzein, hydrate, dibenzoate, 1645⁹.
C₃₃H₅₈N₂O₂ Dibenzocopyrine, 6-(*p*-isopropoxyphenyl) - 2, 3, 10, 11 - tetramethoxy-7-phenyl-, and -HCl, 81⁹.
C₃₃H₅₈N₂Q₂ Dibenzocopyrine, 6-anisyl-7-

- (3,4 - dimethoxyphenyl) - 2,3,10,11-tetramethoxy-, and -HCl, 82¹.
- Dibenzocopyrine, 2,3,10,11-tetramethoxy-6-phenyl - 7 - (3,4,5 - trimethoxyphenyl)-, and -HCl, 82¹.
- C₁₅H₁₂N₂O₂ Chalcone, α,α' -thiois[o-hydroxy-, piperidine compd., 2885⁵.
- C₁₅H₁₂Cl₂N₂O₂ Anthranilaldehyde, *N*-[α -[α -aminobenzalmino]benzalmino]benzal - addn. compd. with anthranilaldehyde, H₂O, and HCl, 76⁸.
- C₁₅H₁₂N₂O₂ Carbanilide, 5,5'-bis[(*p*-carboxyphenyl)carbonyl] - 2,2' - dimethyl-, di-Et ester, 1451⁷.
- C₁₅H₁₂Co₂N₂O₂P₂ + 8H₂O, 2232³.
- C₁₅H₁₂O₂ Filicin, 3252².
- Mannose, diacetone, carbonate, 1634⁷.
- C₁₅H₁₂N₂O₂ See *Ergoline*.
- C₁₅H₁₂N₂O₂ See *Ergotoxine*.
- C₁₅H₁₂N₂O₂ See *Ergotamine*.
- C₁₅H₁₂N₂O₂ See *Ergotamine*, diphenyl-, 591¹.
- C₁₅H₁₂N₂O₂ Oxidation product of rubber, 1901⁸.
- C₁₅H₁₂N₂O₂ Cyclamiretin, 2904⁴.
- C₁₅H₁₂N₂O₂ Oxidation product of rubber, 1901⁸.
- C₁₅H₁₂N₂O₂ See *Ergotamine*, 589⁹.
- C₁₅H₁₂N₂O₂ Cyclamiretin, oxime, 2904⁴.
- C₁₅H₁₂N₂O₂ Prosapogenin, oxime, 589⁹.
- C₁₅H₁₂O Ether, cholesterol *sec*-octyl, 1991⁴.
- C₁₅H₁₂O Ether, of alniviridol, 600¹.
- C₁₅H₁₂O Oleone, 2372³.
- C₁₅H₁₂ClNO Pentatriacontane, 18-chloro-18-nitroso-, 2872³.
- C₁₅H₁₂ClNO Pentatriacontane, 18-chloro-18-nitroso-, 2872³.
- C₁₅H₁₂O Stearic acid, 3372¹.
- C₁₅H₁₂N₂O₂ Phenoxtellurine, 2,8-dinitro-, 2-nitrophenoxtellurine addn. compd., 1251⁹.
- C₁₅H₁₂O₂ 5,14 - Dibenzanthracenedione, 7,12-dihydroxy-, dibenzoate, 1458¹.
- C₁₅H₁₂N₂O₂ 5,7,12,14 - Dibenzanthracene-tetrone, di *p*-toluino-, 1458¹.
- C₁₅H₁₂O₂ Quinone, 2,5-bis(2,4-dihydroxyphenyl), quinhydrone, 2887².
- C₁₅H₁₂O₂ Quinone, 2,5-bis(3,4,5-trihydroxyphenyl), quinhydrone, 2887².
- C₁₅H₁₂AlN₂O₂ Azoxybenzene, *p*-nitrosohydroxylamine, aluminum deriv., 3048⁹.
- C₁₅H₁₂BiN₂O₂ Azoxybenzene, *p*-nitrosohydroxylamine, bismuth deriv., 3048⁹.
- C₁₅H₁₂FeN₂O₂ Azoxybenzene, *p*-nitrosohydroxylamine, ferric deriv., 3048⁹.
- C₁₅H₁₂N Triphenylamine, *ar, ar', ar''*-tri-phenyl-, 681¹.
- C₁₅H₁₂N Benzidine, *N, N'*-bis(phenylphenyl)-, 681¹.
- C₁₅H₁₂CoN₂O₂ Acetophenone, *p*-(2-amino-1-naphthylazo)-, Co compd., 1810⁷.
- C₁₅H₁₂N₂NiO₂ Acetophenone, *p*-(2-amino-1-naphthylazo)-, Ni compd., 1810⁷.
- C₁₅H₁₂ON₂Te₂ + H₂O Compd. from phenox-tellurine, 1104⁹.
- C₁₅H₁₂ Tetraindene, 2471².
- C₁₅H₁₂O₂ 3-Hexine - 1,2,5,6 - tetrol, 1,2,5,6-tetraphenyl-, triacetate, 1631¹.
- C₁₅H₁₂CuO₂ Chalcone, β -hydroxy-4(or 4')-isopropoxy-, Cu deriv., 81⁸.
- C₁₅H₁₂CuO₂ Chalcone, β -hydroxytrimethoxy-, Cu deriv., 81⁸.
- C₁₅H₁₂N₂O₂ Dibenzocopyrine, 6-*m*-anisyl - 7-*p*-anisyl - 2,3,10,11 - tetramethoxy-, acetate, 82¹.
- C₁₅H₁₂N₂O₂ Naphthionis acid, *N*-acetyl-, benzidine salt, 3362¹.
- C₁₅H₁₂IN₂ Compd., m. 182-3°, of 4-anilino-6-methyl - 2 - phenylpyrimidine and the methiodide of 4-methyl-6-methylanilino-2-phenylpyrimidine, 97².
- C₁₅H₁₂BeCl₂N₂ Addn. compd. of BeCl₂ and benzidine, 1601⁹.
- C₁₅H₁₂O₂ Butatriene, 1,1,4,4-tetra-*p*-phenetyl-, 2267².
- Indene, 1 - (di - *p* - phenetilmethylene)-6-ethoxy-3-*p*-phenetyl-, 2268¹.
- C₁₅H₁₂Cl₂O₂ 2-Butene, 2,3-dichloro-1,1,4,4-tetra-*p*-phenetyl-, 2267².
- C₁₅H₁₂Cl₂O₂ Butane, 2,2,3,3-tetrachloro-1,1,4,4-tetra-*p*-phenetyl-, 2267².
- C₁₅H₁₂CuO₂ Cinnamic acid, α,β -diacetyl-3-carboxy - 2,3 - dihydro - 6 - hydroxy-2-keto-, di-Et ester, Cu deriv., 1266⁹.
- C₁₅H₁₂O₂ 1,3-Butadiene, 1,1,4,4-tetra-*p*-phenetyl-, 2268².
- Compd., m. 134°, from 1,1,4,4-tetra-*p*-phenetylbutatriene, 2268¹.
- C₁₅H₁₂N₂O₂ Piperazine, 1,4-bis[*p*-(β -benzamidethoxy)benzyl]-, di-HCl, 566⁹.
- C₁₅H₁₂O₂ Butane, 1,1,4,4-tetra-*p*-phenetyl-, 2268¹.
- C₁₅H₁₂O₂ See *Strophanthin*.
- C₁₅H₁₂N₂O₂ *p, p'*-Bilauranilide, 2884⁸.
- C₁₅H₁₂O₂ Oxidation product of rubber, 1901⁸.
- C₁₅H₁₂Br₂CoN₂O₂ Bistriaminopropanecobaltic α -bromocamphor- α -sulfonate, 388⁸.
- C₁₅H₁₂CoN₂O₂ Bistriaminopropanecobaltic camphor- α -nitronate, 388⁸.
- C₁₅H₁₂CoN₂O₂ Bistriaminopropanecobaltic camphor- β -sulfonate, 388⁸.
- C₁₅H₁₂O₂ Undecylen, 1478⁹.
- C₁₅H₁₂O₂ $\Delta^{1,2}$ -Bi[indan] - 3,1',3' - trione, 2-[1 - (1,3 - diketo - 2 - indanyl)-3-keto-2-methylene-1-indanyl]-, 2667², 3363¹.
- $\Delta^{1,2}$ - Bi[indan] - 3,1',3' - trione, 2,2'-methylenebis-, 3202⁹.
- C₁₅H₁₂N₂O₂ Dibenzoate, m. 274°, of leuco form of indigo yellow 3 Ciba, 90².
- C₁₅H₁₂N₂O₂ 1,2 - Benzacridine - 7 - carboxylic acid, 9,9'-methylenebis[5,6-dihydro-, 1123³.
- C₁₅H₁₂O₂ 2(1) - Benzofuranone, 3,5-dihydroxy-1 - *p* - hydroxybenzyl - 4 - methoxy-(?), tribenzoate, 3051¹.
- C₁₅H₁₂N₂O₂ 2-*p*-Anisyl - 6 - (2,4-cresyl)-1,4-diphenylpyridinium picrate, 410⁶.
- C₁₅H₁₂N₂O₂ 2(and 4)-*p*-Anisyl-6(and 2)-(2-hydroxy - *p* - anisyl) - 1,4(and 1,6)-diphenylpyridinium picrate, 410⁷.
- C₁₅H₁₂N₂O₂ Mandelamide, *N, N'*-benzylbis-, diacetate, 1984⁸.
- C₁₅H₁₂N₂O₂ 3-Indenecarboxylic acid, 2,2'-methylenebis[1 keto-, di Et ester, bis(phenylhydrazine), 3900⁸.
- C₁₅H₁₂O₂ Glucose, 1,2-glycerylene-, tetra-benzoate, 2666¹.
- C₁₅H₁₂N₂O₂ Dibenzocopyrine, 6-*p*-anisyl-7-(3,4 - dimethoxyphenyl) - 2,3,10,11-tetramethoxy-, acetate, 82¹.
- C₁₅H₁₂O₂ Pimelic acid, β,δ -dibenzoyl- α,ϵ -diketo-, di-Et ester, bis(phenylhydrazine), 3900⁸.
- C₁₅H₁₂N₂O₂ Chalcone, α,α' -thiois[*p*-methoxy-, piperidine compd., 2885⁵.
- C₁₅H₁₂As₂N₂O₂ Carbanilide, *m, m'*-bis[5-arsono - 2 - (1 piperidyl)phenyl]carbonyl-, 2694⁹.
- C₁₅H₁₂N₂O₂ Hematomorphyrin, tetramethyl-, 3060³.
- C₁₅H₁₂O₂ Xanthorhamnin, tri-Me ether, 1267⁴.

- C₁₇H₁₅O₃** Quinovic acid, benzoyl deriv., 2894².
C₁₇H₁₅BrO₃ Amyrin, benzoate, Br deriv., 1271¹.
C₁₇H₁₅BrO₃ Allobetulin, *p*-bromobenzoate, 1658⁹.
C₁₇H₁₅NO₃ Allobetulin, *m*-nitrobenzoate, 1659¹.
C₁₇H₁₅O₃ Lupeol, benzoate, 2477⁴.
C₁₇H₁₅O₃ Ether, bornyl cholesteryl, 1991².
C₁₇H₁₅O₁₀ Sapotoxin, 3631².
C₁₇H₁₇Br₂Cl₂N₂Sn, 213⁹.
C₁₈H₁₄ Chrysofluorene - 11,13' - $\alpha\alpha'$ - dibenzofluorene, 239⁴, 581¹.
C₁₈H₁₄N₂O Indole, 3,3'-piperonylidenebis[1-benzoyl-], 1118⁴.
C₁₈H₁₆O β -Benzopinacol, *as-p*, *p'*-diphenyl-, 579².
C₁₈H₁₆N₂ 9,10-Anthradiamine, 9,10-dihydro-*N*, *N'*,9,10-tetraphenyl-, 1115².
C₁₈H₁₆N₂O₁₁ 2,4-Di-*p*-anisyl - 6 - (2-hydroxy *p*-anisyl) - 1 - phenylpyridinium picrate, 410².
C₁₈H₁₆N₂O₁₂ 4-*p*-Anisyl - 2,6 - bis(2 - hydroxy-*p*-anisyl) - 1 - phenylpyridinium picrate, 410².
C₁₈H₁₆O₂ Benzopinacol, *s-p*, *p'*-diphenyl-, 579².
C₁₈H₁₆N₂O₂ Ketone, 2,3-di-*p*-anisyl-4-(α -iminobenzyl)cyclobutyl phenyl, phenylhydrazine, 397².
C₁₈H₁₆CoN₂ 2-Naphthylamine, 1-pseudocumylazo-, Co compd., 1810⁷.
C₁₈H₁₆N₂O₂S Naphthionic acid, *N*-acetyl-, tolidine salt, 3302¹.
C₁₈H₁₆N₂O₂S Naphthionic acid, *N*-acetyl-, biamidine salt, 3302¹.
C₁₈H₁₆N₂ 2-Naphthylamine, 1-pseudocumylazo-, Ni compd., 1810⁶.
C₁₈H₁₆BrO₂ *d*-Glucose, 6- β -heptaacetylcellobiosidoacetobromo-, 1101³.
C₁₈H₁₆O₂ Amyrin anisate, 1272¹.
C₁₈H₁₆O₂ Allobetulin, anisate, 1659¹.
C₁₈H₁₆N₂O₂ *p*, *p'*-Bitridecanoilide, 2884².
C₁₈H₁₆N₂O₂ Palmitamide, *N*, *N'*-*p*-phenylenebis-, 2884².
C₁₈H₁₇O₄ 1,32 - Dotriacontanedicarboxylic acid, di-Et ester, 391¹.
C₁₈H₁₈ Anthracene, 10-diphenylmethylen-9,10-dihydro 9,9-diphenyl-, 164².
C₁₈H₁₈N₂O Diimide, α -triphenylacetyl - β -triphenylmethyl-, 1455².
C₁₈H₁₈N₂O Carbanilide, *p*, *p'*-bis(*p*-benzylaminophenyl)-, 80².
C₁₈H₁₈N₂O₂ Carbanilide, *p*, *p'*-bis(*p*-salicylaminophenyl)-, 80².
C₁₈H₁₈N₂O Acetic acid, triphenyl-, triphenylmethylhydrazide, 1455².
C₁₈H₁₈N₂O Semicarbazide, 1-triphenylmethyl-4-triphenylmethylimino-, 1455².
C₁₈H₁₈N₂O Carbohydrazide, α , δ -bis(triphenylmethyl)-, 1455².
C₁₈H₁₈NO₂S Δ^2 1 - Pentadienone, 2,2'-thiobis[1,5-diphenyl-, piperidine compd., 2885².
C₁₈H₁₈N₂O₂S Chalcone, α , α' -thiobis[*p*-dimethylamino-, piperidine compd., 2885².
C₁₈H₁₈N₂O₁₄ 1,7-Heptanediamine, *N*, *N'*-bis-(1,2,3,4 - tetrahydro - 2 - naphthyl)-, dipicrate, 567¹.
C₁₈H₁₈N₂O₃ Protostephanine, 2700⁴.
C₁₈H₁₈O₂ Cyclamiretin, diacetate, 2904¹.
C₁₈H₁₈KO₂S Potassium glycerosulfate, distearate, 1630⁹.
C₁₈H₁₈K₂O₂P Potassium glycerophosphate, distearate, 1631².
C₁₈H₁₈O₂S Glycerosulfuric acid, distearate, 1630².
C₁₈H₁₇O₂P Glycerophosphoric acid, distearate, 1631¹.
C₁₈H₁₇As₂O₂ Arsine, di-1-naphthyl-, oxide, 3612².
C₁₈H₁₇As₂S₂ Sulfide, bis(di-1-naphthylarsyl), 905¹.
C₁₈H₁₈CoN₂ 2-Naphthylamine, 1-(1-naphthylazo)-, Co compd., 1810⁷.
C₁₈H₁₈N₂O₂ Indole, 3,3'-piperonylidenebis[1-benzoyl-2-methyl-, 1118⁴.
C₁₈H₁₈N₂Ni 2-Naphthylamine, 1-(1-naphthylazo)-, Ni compd., 1810⁷.
C₁₈H₁₈N₂O₂ Hydrazine, *s*-bis(triphenylacetyl)-, 1455².
C₁₈H₁₈CuO₂ γ -Pentenic acid, α -benzoyl- β -keto - δ - phenyl-, ethyl ester, copper deriv., 2901².
C₁₈H₁₈O₂ Benzopinacol, *s-o*, *o'*-dibenzyl-, 1648¹.
C₁₈H₁₈NO₂ Chalcone, 4'-ethyl-, PhNH₂ addn. compd., 398².
C₁₈H₁₈N₂O₂S Chalcone, α , α' -thiobis-, piperidine compd., 288².
C₁₈H₁₈O₂ Spiro[cyclohexane - 1,1' - cyclopropane - 2',1'' - cyclohexane] - 2,6,2'',6''-tetrone, 3',3'''', *p* - phenylenebis[4,4',4'',4'''-tetramethyl-, 3203⁷.
C₁₈H₁₈O₂ 1,3-Cyclohexanedione, 2,2',2'',2'''-isophthalaltetrakis[4,4-dimethyl-, 3203⁷.
C₁₈H₁₈O₂ *d*-Glucose, 6- β -cellobiosido- β -, hendecaacetate, 1101³.
C₁₈H₁₈O₂ *d*-Glucose, 6 - β - cellobiosido- β -, hendecaacetate, 1101³.
C₁₈H₁₈O₂ *d*-Glucose, 6 - β - cellobiosido- β -, hendecaacetate, 1101³.
C₁₈H₁₈O₂ Acid from copal, 2803².
C₁₈H₁₈N₂O₂ *p*, *p'*-Bimyriscanilide, 2884².
C₁₈H₁₈N₂O₁₀ Quinine, C₂O₂ addn. compd., 735².
C₁₈H₁₈O₁₁ *d*-Glucose, pentabenzoyl-, 3184⁷.
C₁₈H₁₈O₂ Chebulonic acid, 2263¹.
C₁₈H₁₈N₂O Urea, *s*-bis(β -triphenylethyl-, 2671¹.
C₁₈H₁₈O₂ Compds., m. 185°, 186°, 228°, and 239°, resp. from 1-phenyl-2-propanone and salicylaldehyde, 80², 81¹.
C₁₈H₁₈NO₂P Colamine, distearoylglycerophosphate, 1660¹.
C₁₈H₁₈ 13,13'-Bi- α , α' -dibenzofluorene, 239⁴, 581¹.
C₁₈H₁₈N₂O₂S Disulfide, bis[2,7-bis(phenylazo)-thiono - 3 - indolecarboxyl], 1460¹.
C₁₈H₁₈ 1,6-Hexadiene, 1,3,3,4,4,6-hexaphenyl-, 1980².
C₁₈H₁₈BaO₂U₂ + 20 to 24 H₂O Barium trisalicylatouranate, 2231¹.
C₁₈H₁₈CaN₂ Imidazole, 2,4,5-triphenyl-, Ca deriv., and *NH*₃ compd., 3054².
C₁₈H₁₈CuN₂ Imidazole, 2,4,5-triphenyl-, Cu deriv., and *NH*₃ compd., 3054².
C₁₈H₁₈MgN₂ Imidazole, 2,4,5-triphenyl-, Mg deriv., 3054².
C₁₈H₁₈Cl₂O₂ Thymolphthalein, tetrachloro-, dibenzoate, 1456².
C₁₈H₁₈Cl₂N₂O₂ Thymolphthalein, tetrachloro-, dicarbanilate, 1456².
C₁₈H₁₈Si₂ Distannane, hexabenzyl-, 904².
C₁₈H₁₈N₂O₁₆ Homopiperonylic acid, 6-[(homopiperonylmethylamino)methyl]-, oxalate, 1270².
C₁₈H₁₇N₂O₂ Stearamide, *N*, *N'*-*p*-phenylenebis-, 2884².
C₁₈H₁₇Cl₁₅N₂Sn, 213⁹.
C₁₈H₁₇Br₁₅Ti₂, 213⁹.
C₁₈H₁₈O₂ Palmitic acid, ceryl ester, 599².
C₁₈H₁₈O₂ $\Delta^{1,3'}$ Bi[indan]-3,1',3'-trione, 2,2''-benzalbis-, 3203⁷.

- C₁₀H₁₆O₄** Dimethyl ether, m. 135°, of compd. I from 1-phenyl-2-propanone and salicylaldehyde, 80°.
- Dimethyl ether, m. 138°, of compd. IV from 1-phenyl-2-propanone and salicylaldehyde, 80°.
- C₁₀H₁₆N₂O₄** Disemicarbazone, m. 230°, of compd. I from 1-phenyl-2-propanone and salicylaldehyde, 80°.
- C₁₀H₁₆N₂O₅** 8,12-trimeso-Benzonaphthacridine-8,12-dione, oxybis[3-methyl-(?)], 1268°.
- C₁₀H₁₆N₂O₁₁** 2,2'-Biindoxyl, 1,1'-bis(*p*-nitrobenzoyl)-, bis(*p*-nitrobenzoate), 88°.
- C₁₀H₁₆Se₂O₂** Scoparin, tetra-Ba deriv., 575°.
- C₁₀H₁₆N₂O₅V** Guanidine, triphenyl-, vanadylmalonate, 2230°.
- C₁₀H₁₆CuO₄** Δ¹, 1,4-Butenediene, 2-hydroxy-1,4-di-2-mesityl-, Cu deriv., 82°.
- C₁₀H₁₆N₂O₁₁V** Cinchonine vanadylmalonate, 2230°.
- C₁₀H₁₆Br₂O₄** Allobetuleol, bis(*p*-bromobenzoate), 1659°.
- C₁₀H₁₆N₂O₅S** Propionic acid, α,α'-sulfonylbis-, cinchonine salt, 1964°.
- C₁₀H₁₆Br₂O₄** Heterobetulin, bis(*p*-bromobenzoate), 1659°.
- C₁₀H₁₆N₂O₅** Betulinol, bis(*m*-nitrobenzoate), 1658°.
- C₁₀H₁₆O₄** Allobetulenol, dibenzoate, 1659°.
- C₁₀H₁₆O₁₁** Glycyrr 3, 3104°.
- C₁₀H₁₆O** H. Pether, 3204°.
- C₁₀H₁₆O₁₁** Resin acid from rubber, 1902°.
- C₁₀H₁₆N₂O₅** *p*, *p'*-Bipalmitanilide, 2884°.
- C₁₀H₁₆Cl₂N₂Tl₂** 212°.
- C₁₀H₁₆N₂O₅** α,α'-distearoylglycerol-β-phosphate endo salt, 1650°.
- C₁₀H₁₆O₁₁** Δ^{1,3'}-Bi[indan]-3,1',3'-trione, 2,2''-(3-keto-1-indanylidene)bis-, 2607°.
- C₁₀H₁₆Br₂O₄** Alc., m. 170°, from compd. from *Asclepias syriaca*, 1271°.
- C₁₀H₁₆O₁₁** Oleic acid, cholesteryl ester, 3219°.
- C₁₀H₁₆O₁₁** Δ^{1,3'}-Bi[indan]-3,1',3'-trione, 2,2''-(3-keto-2-methylene-1-indanylidene)bis-, 2667°, 3363°.
- C₁₀H₁₆N₂O₅** 2,2'-Biindoxyl, 1,1'-dibenzoyl-5,5'-dimethyl-, dibenzoate, 89°.
- C₁₀H₁₆N₂O₄** Phthalyl deriv., m. 221°, of CH₃(C₆H₄NHMe)₂, 2891°.
- C₁₀H₁₆O₅** Betulinol, dianisate, 1658°.
- C₁₀H₁₆Br₂CoN₂O₅S₂** + 3H₂O, 868°.
- C₁₀H₁₆N₂O₅P₂** γ-Ovotyrin, 2476°.
- C₁₀H₁₆O₁₀** Tetrabenzoate, m. 185-7°, of carbinol from pyrogallolbenzene, 1982°.
- C₁₀H₁₆N₂O₇** Carbanilide, *m*, *m'*-bis[*m*-(*o*-phenetylcarbonyl)phenylcarbonyl], 1451°.
- C₁₀H₁₆O₄** Compd. IV, benzene compd., m. 209°, from 1-phenyl-2-propanone and salicylaldehyde, 80°.
- C₁₀H₁₆N₂O₅S** Valeric acid, α-sulfo-, strychnine salt, 3600°.
- C₁₀H₁₆N₂O₁₀** 1,7-Heptanediamine, *N*, *N'*-bis-(1,2,3,4-tetrahydro-2-naphthyl)-, dipicrolonate, 567°.
- C₁₀H₁₆Br₂O₄** Bromo deriv., m. 201°, of compd. from *Asclepias syriaca*, 1271°.
- C₁₀H₁₆Cu₂Fe₂O₁₁** Iron cuprimandate, 3168°.
- C₁₀H₁₆N₂P₂** 870°.
- C₁₀H₁₆N₂O₁₁V** Strychnine, vanadylmalonate, 2230°.
- C₁₀H₁₆N₂O₁₁** Allomucic acid, strychnine salt, 1258°.
- Mucic acid, strychnine salt, 1258°.
- C₁₀H₁₆Br₂O₄** Propionate, m. 214°, of alc. from *Asclepias syriaca*, 1271°.
- C₁₀H₁₆N₂O₅** *p*, *p'*-Histearanilide, 2884°.
- C₁₀H₁₆O₁₁** Cyclamiretin, dibenzoate, 2904°.
- C₁₀H₁₆O₅** Gitonin, 2992°.
- C₁₀H₁₆O₅** Benzopinacol, *p*, *p'*, *p''*, *p'''*-tetraphenyl-, 579°.
- C₁₀H₁₆N₂** Anthracene, 9,10-dihydro-9,9,10,10-tetrakis(2-methyl-3-indyl)-, 242°.
- C₁₀H₁₆N₂O₅S₂** Carbanilide, *p*, *p'*-bis[5-(4,6,8-trisulfo-1-naphthylcarbonyl)-*o*-tolylcarbonyl], Na salt, P 1582°.
- C₁₀H₁₆N₂O₁₁S** Valeric acid, α-sulfo-, brucine salt, 3600°.
- C₁₀H₁₆N₂** Hydrazine, tetra-9-fluoryl-, 3052°.
- C₁₀H₁₆** 9,9' Bianthryl, 9,10,9',10'-tetrahydro-10,10',10'-tetraphenyl-, 1648°.
- C₁₀H₁₆N₂O₁₁** Allomucic acid, brucine salt, 1258°.
- Mucic acid, brucine salt, 1258°.
- C₁₀H₁₆O₁₁** Heterobetulin, dibenzoate, 1659°.
- C₁₀H₁₆O** Ether, dicholesteryl, 1991°.
- C₁₀H₁₆O₇** Stearin, palmitti-, 3344°.
- C₁₀H₁₆Cl₂N₂O₂Pt** 5-Acetamido-12-amino-7-phenyl-α,γ'-dibenzophenazonium chloroplatinate, 1988°.
- C₁₀H₁₆O₆** Olein, 2596°.
- C₁₀H₁₆N₂O₁₀** Diphenic acid, 3,3'-diacetamido-, quinine salt, 2892°.
- C₁₀H₁₆O₁₁** Oxidation product of rubber, 1902°.
- C₁₀H₁₆O₄** Binaphthylene oxide, binaphthylbisperoxy-, 405°.
- C₁₀H₁₆Cl₂N₂Pt** 6-Amino-1,2,3-triphenyl-5,6-benzoquinoxalium chloroplatinate, 1987°.
- C₁₀H₁₆N₂** Benzidine, *N*, *N*, *N'*, *N'*-tetrakis(phenylphenyl)-, 68°.
- C₁₀H₁₆Cl₂N₂O₂Pt** 5,12-Diacetamido-7-phenyl-α,γ'-dibenzophenazonium chloroplatinate, 1988°.
- C₁₀H₁₆N₂O₁₀S** Glycerosulfuric acid, distearate, strychnine salt, 1630°, 1631°.
- C₁₀H₁₆O₁₁** Ether, di-β-amylin, 1271°.
- C₁₀H₁₆N₂O₁₀P** Glycerophosphoric acid, distearate, strychnine salt, 1631°.
- C₁₀H₁₆N₂O₁₁** Disemicarbazone from aldehydic oxidation product of rubber, 1902°.
- C₁₀H₁₆N₂O₄** Compd., m. 220-40°, from *N*-[*o*-[*o*-(*o*-aminobenzalanino)benzalaninol-benzal]anthranilaldehyde and 2,4-dinitroaniline, 76°.
- C₁₀H₁₆N₂O₁₀S** Glycerosulfuric acid, distearate brucine salt, 1630°.
- C₁₀H₁₆N₂O₁₀P₂** Lactotyrine from casein, 1281°.
- C₁₀H₁₆O₁₁** Compd., m. 256°, from 2,5-dibenzyl-3,6-diphenylquinone and KOH, 1804°.
- C₁₀H₁₆N₂** Benzidine, *N*, *N*, *N'*, *N'*-tetrakis(phenylphenyl)-, toluene addn. compd., 68°.
- C₁₀H₁₆N₂O₁₀P₂** Lactotyrine from casein, 1281°.
- C₁₀H₁₆AlN₂O₁₁** + 12H₂O, 1416°.
- C₁₀H₁₆Cl₂N₂Pt** 14-Methyl-7,9-diphenyl-1,2-benzofluorindinium chloroplatinate, 2272°.
- C₁₀H₁₆N₂O₁₁** Benzidine, *N*, *N*, *N'*, *N'*-tetrakis(phenylphenyl)-, PhNO₂ addn. compd., 68°.
- C₁₀H₁₆N₂O₁₀P₂** Lactotyrine from casein, 1281°.
- C₁₀H₁₆Fe₂N₂O₁₁P₂** β-Ovotyrin, 2476°.
- C₁₀H₁₆AlN₂O₁₁** + 12H₂O, 1416°.
- C₁₀H₁₆KO₁₀P** Potassium diglycerophosphate, tetrastearate, 1631°.
- C₁₀H₁₆N₂O₁₀P** Diglycerophosphoric acid, tetrastearate, 1631°.
- C₁₀H₁₆O₁₁** Tiglic acid, apocholic acid addn. compd., 1127°.

- C₁₀₁H₁₆₈O₁₈** Tiglic acid, desoxycholic acid addn. compd., 1127⁵.
C₁₀₁H₁₇₁Cl₇O₂₄ Compd. from rubber and CrO₂Cl₂, 1902⁵.
C₁₀₂H₁₇₀O₁₈ Sorbic acid, apocholic acid addn. compd., 1127⁵.
C₁₀₂H₁₈₁O₁₈ Sorbic acid, desoxycholic acid addn. compd., 1127⁵.
C₁₀₂H₁₇₁O₁₈ Euanthic acid, desoxycholic acid addn. compd., 1127⁵.
C₁₀₄H₁₇₀O₁₈ Caprylic acid, desoxycholic acid addn. compd., 1127⁵.
C₁₁₂H₂₃₁O₂₆ Pelargonic acid, desoxycholic acid addn. compd., 1127⁵.
C₁₁₄H₂₅₀O₂₆ Capric acid, desoxycholic acid addn. compd., 1127⁵.
C₁₁₄H₂₅₀O₂₆ Undecylenic acid, desoxycholic acid addn. compd., 1127⁵.
C₁₁₄H₂₅₀O₂₆ Undecylic acid, desoxycholic acid addn. compd., 1127⁵.
C₁₁₄H₂₅₂O₂₆ Lauric acid, desoxycholic acid addn. compd., 1127⁵.
C₁₁₅H₂₅₂O₂₆ *n*-Tridecoic acid, desoxycholic acid addn. compd., 1127⁵.
C₁₁₅H₂₅₂O₂₆ Myristic acid, desoxycholic acid addn. compd., 1127⁵.
C₂₀₇H₃₁₀O₃₄ Pentadecic acid, desoxycholic acid addn. compd., 1127⁵.
C₂₀₈H₃₁₂O₃₄ Palmitic acid, desoxycholic acid addn. compd., 1127⁵.
C₂₀₉H₃₁₄O₃₄ Margarin acid, desoxycholic acid addn. compd., 1127⁵.
C₂₁₀H₃₁₆O₃₄ Stearolic acid, desoxycholic acid addn. compd., 1127⁵.
C₂₁₀H₃₁₆O₃₄ Stearic acid, desoxycholic acid addn. compd., 1127⁵.
C₂₁₂H₃₀₀O₃₄ Arachidic acid, desoxycholic acid addn. compd., 1127⁵.
C₂₁₂H₃₀₀O₃₄ Behenolic acid, desoxycholic acid addn. compd., 1127⁵.
C₂₁₄H₃₀₂Br₂O₂₄ Behenic acid, dibromo, desoxycholic acid addn. compd., 1127⁵.
C₂₁₄H₃₀₂O₃₄ Brassidic acid, desoxycholic acid addn. compd., 1127⁵.
C₂₁₄H₃₀₄O₃₄ Behenic acid, desoxycholic acid addn. compd., 1127⁵.
C₂₁₆H₃₀₈O₃₄ Behenic acid, Et ester, apocholic acid addn. compd., 1127⁵.
C₂₁₆H₃₀₈O₃₄ Behenic acid, Et ester, desoxycholic acid addn. compd., 1127⁵.
C₂₁₈H₃₁₂O₃₄ Lignoceric acid, desoxycholic acid addn. compd., 1127⁵.
C₂₁₈H₃₁₂O₃₄ Cerotic acid, desoxycholic acid addn. compd., 1127⁵.
C₂₁₈H₃₁₂O₃₄ Stearic acid, α -octyl-, desoxycholic acid addn. compd., 1127⁵.
C₂₁₉H₃₁₇O₃₄ Heptacosic acid, desoxycholic acid addn. compd., 1127⁵.
C₂₂₂H₃₁₂O₃₄ Montanic acid, Et ester, desoxycholic acid addn. compd., 1127⁵.
C₂₇H₃₁₄O₃₄ Palmitic acid, cetyl ester, desoxycholic acid addn. compd., 1127⁵.
CaCl₂ See *Calcium chloride*.
CaCl₂O See *Bleaching powder*.
CaCl₂O₂ See *Calcium hypochlorite*.
CaCl₂Mg₂ + 12H₂O See *Tachydrate*.
CaCrO₄ See *Calcium chromate*.
CaCr₂O₄ Calcium chromite, 2443¹.
CaF₂ See *Calcium fluoride*; *Fluorite*.
CaFe₂O₄ Calcium ferrate, 1309⁴.
CaHO₂P See *Calcium phosphates*; *Brushite*.
CaH₂ See *Calcium hydride*.
CaH₂O₂ See *Calcium hydroxide*.
CaI₂ See *Calcium iodide*.
CaNa₂O₂ See *Calcium nitrate*.
Ca₂Na₂Si₂, 28⁴.
CaNa₂O₂Si Calcium sodium silicate, 346⁴.
CaNa₂O₂Si₂ Calcium sodium silicate, 346⁴.
CaO See *Lime*.
CaO₂Si See *Calcium silicate*.
CaO₂Sn See *Calcium stannate*.
CaO₂S See *Anhydrite*; *Calcium sulfate*; *Gypsum*.
CaO₂W See *Scheelite*.
CaO₂Si₂Ti₂ See *Calcium-ramsayite*.
CaO₂Si₂U₂ + 7H₂O See *Uranophane*.
CaO₂P₂U₂ + 12H₂O See *Autunite*.
CaS See *Calcium sulfides*.
Ca₂Si See *Calcium sulfides*.
CaSe See *Calcium selenide*.
CaSi See *Calcium silicides*.
Ca₂Si₂ See *Calcium silicides*.
CaTe See *Calcium telluride*.
Ca₂Cu₂O₂V₂ + H₂O See *Tangite*.
Ca₂Fe₂O₂Sb₂Ti₂ See *Lewisite*.
CaFe₂O₄, 3323⁷.
Ca₂Fe₂O₄ Calcium ferrate, 1399⁴, 3323⁷.
Ca₂HNa₂O₂Si₂ See *Pectolite*.
Ca₂Na₂O₂Si₂ Calcium sodium silicate, 346⁴.
Ca₂Cb₂F₂H₂O₂Si₂Zr See *Chalcolamprite*.
Ca₂Fe₂O₂ Calcium ferrate, 1399⁴.
Ca₂O₂P₂ See *Calcium hypophosphite*.
Ca₂O₂P₂ See *Calcium phosphates*.
Ca₂O₂V₂ See *Calcium vanadate*.
Ca₂Fe₂O₂ Calcium ferrate, 1399⁴.
Ca₂Fe₂O₂P₂ See *Apatite*.
Ca₂Fe₂O₂, 3323⁷.
CbCl₂O See *Columbium oxychloride*.
CbCl₃ See *Columbium chloride*.
Cb₂Fe₂O₂ See *Columbite*.
Cb₂O₂ See *Columbium oxide*.
CdCl₂ See *Cadmium chloride*.
CdCl₂K Cadmium potassium chloride, 3570⁴.
CdCl₂K₂ Cadmium potassium chloride, 1772¹, 3570⁴.
CdCl₂Na₂ Cadmium sodium chloride, 1772¹.
CdCu₂, 3593⁴.
CdH₂O₂ See *Cadmium hydroxide*.
CdHg₂S₂ Cadmium mercury sulfide, 1424³.
CdI₂ See *Cadmium iodide*.
CdI₂K₂ Cadmium potassium iodide, 1772¹.
CdO₂S See *Cadmium sulfate*.
CdS See *Cadmium sulfide*.
Cd₂Sb Cadmium antimonide, 2655⁴.
CdTe See *Cadmium telluride*.
Cd₂Cl₂H₂N₂O₁₀ + 2H₂O, 1184².
Cd₂Mg₂, 3529¹.
Cd₂O See *Cadmium oxide*.
CeCl₃ See *Cerium chloride*.
CeH₂O₂ See *Cerium hydroxide*.
CeH₂O₂ See *Cerium hydroxides*.
CeH₂N₂O₁₁ Ammonium cerium nitrate, 3294⁴.
CeN₂O₂ See *Cerium nitrate*.
CeO₂ See *Cerium oxides*.
Ce₂O₂ See *Cerium oxides*.
Ce₂O₂Si₂Ti₂ + 4H₂O Cerium thallium sulfate, 543³.
Ce₂O₂Si₂Ti₂ + (?)H₂O Cerium thallium sulfate, 543³.
Ce₂O₂Si₂Ti₂ Cerium thallium sulfate, 543³.
ClCoH₂N₂O₂Si₂, 2442⁴.
ClCoH₂N₂O₂Si₂, 2442⁴.
ClCoH₂N₂O₂, 2082¹.
ClCrO Chromium oxychloride, 1593³.
ClCs See *Cesium chloride*.
ClCu See *Copper chlorides*.
ClFeO Iron oxychloride, 3572⁴.
ClH See *Hydrochloric acid*.
ClHO See *Hypochlorous acid*.

- ClHO_3 See *Chloric acid*.
 ClHO_3S See *Chlorosulfonic acid*.
 ClHO_4 See *Perchloric acid*.
 $\text{ClH}_2\text{O}_2\text{Eu}$, 2441⁷.
 ClH_4N See *Ammonium chloride*.
 ClH_4NO_4 See *Ammonium perchlorate*.
 $\text{ClH}_2\text{N}_2\text{O}_2\text{Pt}$, 2621¹.
 $\text{ClH}_2\text{N}_2\text{O}_2\text{Pt}$, 2621¹.
 $\text{ClH}_2\text{N}_2\text{O}_2\text{Pt}$, 2621¹.
 $\text{ClH}_2\text{N}_2\text{O}_2\text{Pt}$, 2621¹.
 $\text{ClH}_2\text{N}_2\text{O}_2\text{Pt}$, 2621¹.
 ClHg See *Mercury chlorides*.
 ClI See *Iodine chlorides*.
 ClIPb Lead chloriodide, 3303¹.
 ClISn Tin chloriodide, 3571¹.
 ClK See *Potassium chloride; Sylvite*.
 ClKO_2 See *Potassium chlorate*.
 ClKO_4 See *Potassium perchlorate*.
 ClLi See *Lithium chloride*.
 ClLiO_2 See *Lithium chlorate*.
 ClLiO_3 See *Lithium perchlorate*.
 $\text{ClMoO} + 4\text{H}_2\text{O}$ Molybdenyl chloride, 1235⁴.
 ClNO See *Nitrosyl chloride*.
 ClN_2 Chlorazide, 1229⁷.
 ClNa See *Sodium chloride*.
 ClNaO See *Sodium hypochlorite*.
 ClNaO_2 See *Sodium chlorate*.
 ClNaO_4 See *Sodium perchlorate*.
 ClNaO_5 See *Sodium perchlorate*.
 ClO_2PbSb See *Nadorite*.
 ClO_2PbPb See *Pyromorphite*.
 ClEb See *Rubidium chloride*.
 ClEu See *Ruthenium chlorides*.
 ClSn See *Tin chlorides*.
 ClTi See *Thallium chloride*.
 ClBa See *Barium chloride*.
 ClCo See *Cobalt chloride*.
 $\text{Cl}_2\text{CoH}_2\text{O}_{11}$, 2231⁹.
 Cl_2Cr See *Chromium chlorides*.
 Cl_2CrO_2 Chromyl chloride, 1931⁵.
 Cl_2Cu See *Copper chlorides*.
 $\text{Cl}_2\text{CuH}_2\text{N}_2\text{O}_8$, 868³, 1184⁴.
 Cl_2Cu_2 See *Copper chlorides*.
 Cl_2Fe See *Iron chlorides*.
 Cl_2HOEu , 2441⁷.
 $\text{Cl}_2\text{H}_2\text{O}_2\text{Pb}$ See *Laurionite; Paralaurionite*.
 $\text{Cl}_2\text{H}_2\text{N}_2\text{Pt}$, 712⁶.
 $\text{Cl}_2\text{H}_2\text{N}_2\text{NiO}_8$, 1184⁵.
 $\text{Cl}_2\text{H}_2\text{N}_2\text{O}_2\text{Pt}$, 3298³.
 $\text{Cl}_2\text{H}_2\text{N}_2\text{O}_2\text{PtS}$, 2620⁸.
 Cl_2Hg See *Mercury chlorides*.
 Cl_2Hg_2 See *Mercury chlorides*.
 Cl_2LiRb Lithium rubidium chloride, 3572⁸.
 Cl_2Mg See *Magnesium chloride*.
 $\text{Cl}_2\text{MgO}_4 + 3\text{H}_2\text{O}$ See *Magnesium perchlorate*.
 $\text{Cl}_2\text{Mg}_2\text{O}_3 + 12\text{H}_2\text{O}$ Magnesium oxychloride, 2773¹, P 3256¹.
 Cl_2Mn See *Manganese chloride*.
 Cl_2NP Phosphonitrile chloride, 870¹.
 $\text{Cl}_2\text{N}_2\text{O}_2\text{Pd}$ Addn. compd. of PdCl_2 and NO , 1068⁸.
 Cl_2Ni See *Nickel chlorides*.
 Cl_2O See *Chlorine oxide*.
 Cl_2OS See *Thionyl chloride*.
 Cl_2O_3 See *Sulfuryl chloride*.
 $\text{Cl}_2\text{O}_4\text{W}$ See *Tungsten oxychloride*.
 $\text{Cl}_2\text{O}_5\text{S}$ Pyrosulfuryl chloride, 365³, 1069⁹.
 Cl_2Pb See *Lead chlorides*.
 Cl_2Pd See *Palladium chloride*.
 Cl_2Ru See *Ruthenium chlorides*.
 Cl_2S See *Sulfur chlorides*.
 Cl_2S_2 See *Sulfur chlorides*.
 Cl_2Sn See *Tin chlorides*.
 Cl_2Sr See *Strontium chloride*.
 Cl_2Zn See *Zinc chloride*.
 $\text{Cl}_2\text{CoH}_2\text{N}_2$, 677⁸, 3571².
 $\text{Cl}_2\text{CoH}_2\text{N}_2\text{O}_2$, 3571².
 $\text{Cl}_2\text{CoH}_2\text{N}_2\text{O}_2$, 677⁸.
 $\text{Cl}_2\text{CoH}_2\text{N}_2\text{O}_2$, 27⁸.
 $\text{Cl}_2\text{CoH}_2\text{N}_2\text{O}_2$, 677⁸, 3571².
 $\text{Cl}_2\text{CoH}_2\text{N}_2\text{O}_2$, 677⁸.
 $\text{Cl}_2\text{CoH}_2\text{N}_2\text{O}_2$, 677⁸, 1773⁹.
 $\text{Cl}_2\text{CoH}_2\text{N}_2\text{O}_2$, 677⁸.
 $\text{Cl}_2\text{CoH}_2\text{N}_2\text{O}_2$, 677⁸.
 $\text{Cl}_2\text{CoH}_2\text{N}_2\text{O}_{13}$, 2231⁹.
 $\text{Cl}_2\text{CoH}_2\text{N}_2$, 677⁸.
 $\text{Cl}_2\text{CoRb} + 2\text{H}_2\text{O}$ Cobalt rubidium chloride, 1398⁸.
 Cl_2Cr See *Chromium chlorides*.
 $\text{Cl}_2\text{CrH}_2\text{O}_4 + 2\text{H}_2\text{O}$, 3572⁸.
 $\text{Cl}_2\text{CrH}_2\text{O}_6$, 3572⁸.
 $\text{Cl}_2\text{CrH}_2\text{N}_2$, 3572⁸.
 $\text{Cl}_2\text{CrH}_2\text{N}_2 + \text{H}_2\text{O}$, 3572¹.
 $\text{Cl}_2\text{CuH}_2\text{N}_2 + 2\text{H}_2\text{O}$ Ammonium pyper chloride, 3500⁸.
 $\text{Cl}_2\text{CuK} + 2\text{H}_2\text{O}$ Copper potassium chloride, 3500⁸.
 $\text{Cl}_2\text{CuRb} + 2\text{H}_2\text{O}$ Copper rubidium chloride, 3500⁸.
 Cl_2Dy See *Dysprosium chloride*.
 Cl_2Fe See *Iron chlorides*.
 $\text{Cl}_2\text{GdO}_2 + 10\text{H}_2\text{O}$ Gadolinium chlorate, 365⁸.
 $\text{Cl}_2\text{GdO}_2 + 8\text{H}_2\text{O}$ Gadolinium perchlorate, 365⁸.
 Cl_2GeH_2 Germane, trichloro, 27⁷.
 $\text{Cl}_2\text{H}_2\text{NPr}$, 1218⁹.
 $\text{Cl}_2\text{H}_2\text{NPr}$, 1218⁹.
 $\text{Cl}_2\text{H}_2\text{NPr}$, 1218⁹.
 $\text{Cl}_2\text{H}_2\text{N}_2\text{O}_2\text{Pt}$, 2622⁸ 7.
 $\text{Cl}_2\text{H}_2\text{N}_2\text{Pr}$, 1218⁹.
 Cl_2I See *Iodine chlorides*.
 $\text{Cl}_2\text{KMg} + 6\text{H}_2\text{O}$ See *Carnallite*.
 $\text{Cl}_2\text{KPb} + 1/3\text{H}_2\text{O}$ Lead potassium chloride, 1602⁷.
 Cl_2La See *Lanthanum chlorides*.
 $\text{Cl}_2\text{Mo} + 3\text{H}_2\text{O}$ See *Molybdenum chloride*.
 Cl_2N See *Nitrogen chloride*.
 Cl_2OP See *Phosphorus oxychloride*.
 Cl_2P See *Phosphorus chlorides*.
 Cl_2Pr See *Praseodymium chloride*.
 Cl_2Ru See *Ruthenium chlorides*.
 Cl_2Sb See *Antimony chlorides*.
 Cl_2Sc See *Scandium chloride*.
 Cl_2Sm See *Samarium chloride*.
 Cl_2Ti See *Titanium chlorides*.
 Cl_2Yt See *Yttrium chloride*.
 $\text{Cl}_2\text{CoRb}_2 + 2\text{H}_2\text{O}$ Cobalt rubidium chloride, 1398⁸.
 Cl_2CrK Chromium potassium chloride, 3572⁸.
 $\text{Cl}_2\text{Cu}_2\text{H}_2\text{N}_2\text{O}_{16} + 4\text{H}_2\text{O}$ See *Buttgenbachite*.
 $\text{Cl}_2\text{Cu}_2\text{H}_2\text{N}_2\text{O}_{16} + 4\text{H}_2\text{O}$ See *Connellite*.
 Cl_2FeNO , 3573⁹.
 Cl_2Ge See *Germanium chloride*.
 $\text{Cl}_2\text{H}_2\text{N}_2\text{Pt}$, 3571².
 $\text{Cl}_2\text{H}_2\text{N}_2\text{O}_2\text{Pt}$, 2621¹.
 $\text{Cl}_2\text{H}_2\text{N}_2\text{Pt}$, 2622⁸.
 $\text{Cl}_2\text{H}_2\text{N}_2\text{O}_2\text{Pt}$, 2621².
 Cl_2HgK_2 Mercury potassium chloride, 3570⁸.
 $\text{Cl}_2\text{I}_2\text{Sn}_2$ Tin chloriodide, 3324⁵.
 $\text{Cl}_2\text{K}_2\text{Pt}$ Potassium chloroplatinite, 3289⁷.
 $\text{Cl}_2\text{O}_5\text{S}$, 1771¹.
 Cl_2Pt See *Platinum chloride*.
 $\text{Cl}_2\text{Ru} + 5\text{H}_2\text{O}$ See *Ruthenium chlorides*.
 Cl_2S See *Sulfur chlorides*.
 Cl_2Si See *Silicon tetrachloride*.
 Cl_2Sn See *Tin chlorides*.
 Cl_2Th See *Thorium chloride*.
 Cl_2Ti See *Titanium chlorides*.
 Cl_2Zr See *Zirconium chloride*.
 $\text{Cl}_2\text{CsH}_5\text{IrN}_2$, 2622⁸.

- $\text{Cl}_2\text{H}_2\text{K}_2\text{O}_2\text{Ru}$, 2441⁷.
 $\text{Cl}_2\text{H}_2\text{Ru}$ Chlororuthenous acid, 2441⁷.
 $\text{Cl}_2\text{H}_2\text{IrN}_3$, 2622⁸.
 $\text{Cl}_2\text{H}_2\text{N}_2\text{O}_2\text{Pt}$, 2622⁸.
 $\text{Cl}_2\text{H}_2\text{N}_2\text{NiO}_2 + 3\text{H}_2\text{O}$, 1184⁸.
 $\text{Cl}_2\text{K}_2\text{Pb}$ Lead potassium chloride, 1802⁷.
 $\text{Cl}_2\text{K}_2\text{Ru} + \text{H}_2\text{O}$ Potassium pentachlororuthenate, 870⁸.
 Cl_2P See *Phosphorus chlorides*.
 Cl_2Sb See *Antimony chlorides*.
 Cl_2Ta See *Tantalum chlorides*.
 Cl_2Fe See *Iron chlorides*.
 $\text{Cl}_2\text{H}_2\text{Ir}$ Chloroiridic acid, 1779⁸.
 $\text{Cl}_2\text{H}_2\text{Os}$ Chloroosmic acid, 1779⁸.
 $\text{Cl}_2\text{H}_2\text{Pt}$ See *Chloroplatinic acid*.
 $\text{Cl}_2\text{H}_2\text{Rh}$ Chlororhodic acid, 1779⁸.
 $\text{Cl}_2\text{H}_2\text{Ru}$ Chlororuthenic acid, 2441⁷.
 $\text{Cl}_2\text{H}_2\text{N}_2\text{Pb}$ Ammonium hexachloroplumbate, 517¹.
 $\text{Cl}_2\text{H}_2\text{N}_2\text{O}_2\text{PtS}$, 2622⁸.
 $\text{Cl}_2\text{K}_2\text{Pt}$ See *Potassium chloroplatinate*.
 $\text{Cl}_2\text{K}_2\text{Sn}$ See *Potassium chlorostannate*.
 $\text{Cl}_2\text{NO}_2\text{Sb}$, 3573⁸.
 $\text{Cl}_2\text{N}_2\text{O}_2\text{Pb}$, 3573⁸.
 $\text{Cl}_2\text{N}_2\text{O}_2\text{Sn}$, 3573⁸.
 $\text{Cl}_2\text{N}_2\text{O}_2\text{Ti}$, 1418^{8, 9}, 3573⁸.
 $\text{Cl}_2\text{N}_2\text{P}_2$ Triphosphonitrile chloride, 870¹.
 $\text{Cl}_2\text{Na}_2\text{Pt}$ See *Sodium chloroplatinate*.
 $\text{Cl}_2\text{O}_2\text{P}_2\text{S}$ Addn. compd. of SO_2 and POCl_3 , 1770⁸.
 $\text{Cl}_2\text{Rb}_2\text{Sn}$, 3571⁴.
 Cl_2W See *Tungsten chlorides*.
 $\text{Cl}_2\text{H}_2\text{N}_2\text{Pt}$, 2622⁸.
 $\text{Cl}_2\text{N}_2\text{P}_2$ Tetraphosphonitrile chloride, 870¹.
 $\text{Cl}_2\text{N}_2\text{O}_2\text{Sn}$, 1418⁹.
 $\text{Cl}_2\text{N}_2\text{O}_2\text{Tk}$, 1419¹.
 Cl_2Sb Antimony chloride, 3301⁵.
 $\text{Cl}_2\text{H}_2\text{Ir}_2\text{N}_2\text{Pt}$, 2622⁸.
 $\text{Cl}_2\text{H}_2\text{N}_2\text{Pt} + 2\text{H}_2\text{O}$, 2622⁸.
 $\text{Cl}_2\text{H}_2\text{NO}_2\text{Rh}$, 808⁸.
 $\text{Cl}_2\text{N}_2\text{O}_2\text{Sn}$, 1418⁹, 1419¹.
 $\text{CoCu}_2\text{N}_2\text{O}_2 + 42\text{H}_2\text{O}$ Cobalt copper nitrate, 1235⁷.
 CoF_2 See *Cobalt fluoride*.
 $\text{CoH}_2\text{N}_2\text{Na}_2\text{O}_2 + 2\text{H}_2\text{O}$, 27⁵.
 $\text{CoH}_2\text{N}_2\text{O}_2\text{S}$ Ammonium cobalt sulfate, 3503⁸.
 $\text{CoH}_2\text{N}_2\text{O}_2\text{P} + 2$ or $3\text{H}_2\text{O}$, 366⁷.
 $\text{CoH}_2\text{N}_2\text{O}_2\text{S} + 2\text{H}_2\text{O}$, 2442⁸.
 $\text{CoH}_2\text{N}_2\text{O}_2\text{P}$, 366⁷.
 $\text{CoH}_2\text{N}_2\text{O}_2\text{S}$, 2442⁸.
 $\text{CoH}_2\text{N}_2\text{O}_2\text{S}$, 2442⁸.
 $\text{CoH}_2\text{N}_2\text{O}_2\text{S}$, 2442⁸.
 $\text{CoH}_2\text{N}_2\text{O}_2\text{S}$, 3298⁸.
 $\text{CoH}_2\text{N}_2\text{O}_2\text{S} + 3\text{H}_2\text{O}$, 27⁵.
 $\text{CoH}_2\text{N}_2\text{O}_2\text{P} + 2\text{H}_2\text{O}$, 366⁷.
 $\text{CoH}_2\text{N}_2\text{O}_2\text{S}$, 1384¹, 3500⁸.
 $\text{CoK}_2\text{O}_2\text{S}$ Cobalt potassium sulfate, 16³, 3503⁸.
 CoN_2O_2 See *Cobalt nitrate*.
 CoO See *Cobalt oxides*.
 CoO_2S See *Cobalt sulfate*.
 CoS See *Cobalt sulfides*.
 CoS_2 See *Cobalt sulfides*.
 CoSb See *Cobalt antimonide*.
 CoSe See *Cobalt selenide*.
 CoTe See *Cobalt telluride*.
 $\text{Co}_2\text{O}_2\text{H}_2\text{N}_2\text{O}_2\text{S}$, 2442⁸.
 $\text{Co}_2\text{H}_2\text{N}_2\text{O}_2\text{S}$, 2442⁸.
 $\text{Co}_2\text{H}_2\text{N}_2\text{O}_2\text{S} + \text{H}_2\text{O}$, 2442⁸.
 $\text{Co}_2\text{H}_2\text{N}_2\text{O}_2\text{S}$, 2442⁸.
 Co_2O_2 See *Cobalt oxides*.
 $\text{Co}_2\text{O}_2\text{S}$ See *Cobalt sulfates*.
 Co_2O_2 See *Cobalt oxides*.
 $\text{Co}_2\text{O}_2\text{P}_2$ See *Cobalt phosphates*.
 Co_2S_2 See *Cobalt sulfides*.
 $\text{Co}_2\text{N}_2\text{S}_2$ See *Linnite*.
 CrF_2 See *Chromium fluoride*.
 CrH_2O_2 See *Chromic acid*.
 CrH_2O_2 See *Chromium hydroxide*.
 $\text{CrH}_2\text{O}_2\text{Zr}$ Zirconium chromate, 689¹.
 $\text{CrH}_2\text{N}_2\text{O}_2$ See *Ammonium chromate*.
 $\text{CrH}_2\text{O}_2\text{Zr}$ Zirconium chromate, 689¹.
 $\text{CrK}_2\text{O}_2 + 12\text{H}_2\text{O}$ See *Alums*.
 CrK_2O_2 See *Potassium chromate*.
 CrMgO_2 See *Magnesium chromate*.
 CrN_2O_2 See *Chromium nitrate*.
 CrNa_2O_2 See *Sodium chromate*.
 CrO_2Pb See *Lead chromate*.
 CrO_2Ra Radium chromate, 1590⁸.
 CrO_2Sr See *Strontium chromate*.
 CrS See *Chromium sulfides*.
 CrSb See *Chromium antimonide*.
 CrSe See *Chromium selenide*.
 CrTe See *Chromium telluride*, 3499⁸.
 Cr_2FeO_2 See *Chromite*.
 $\text{Cr}_2\text{H}_2\text{O}_2$ See *Dichromic acid*.
 $\text{Cr}_2\text{H}_2\text{N}_2\text{O}_2$ See *Ammonium dichromate*.
 $\text{Cr}_2\text{H}_2\text{O}_2\text{Zr}$ Zirconium chromate, 689¹.
 $\text{Cr}_2\text{K}_2\text{O}_2$ See *Potassium dichromate*.
 Cr_2MgO_2 See *Magnesium dichromate*.
 Cr_2MnO_2 See *Manganese dichromate*.
 $\text{Cr}_2\text{N}_2\text{O}_2$ See *Chromium nitrate*.
 Cr_2O_2 See *Chromium oxides*.
 Cr_2O_2 See *Chromium chromate*.
 $\text{Cr}_2\text{O}_2\text{Pb}$ See *Lead dichromate*.
 $\text{Cr}_2\text{O}_2\text{Zr}$ Zirconium chromate, 689¹.
 $\text{Cr}_2\text{O}_2\text{S}$ See *Chromium sulfates*.
 Cr_2S_2 See *Chromium sulfides*.
 $\text{Cr}_2\text{Gd}_2\text{K}_2\text{O}_2 + 7\text{H}_2\text{O}$ Gadolinium potassium chromate, 365⁸.
 Cr_2O_2 See *Chromium oxides*.
 $\text{Cr}_2\text{Fe}_2\text{O}_2$ See *Iron dichromate*.
 $\text{Cr}_2\text{Gd}_2\text{K}_2\text{O}_2 + 10\text{H}_2\text{O}$ Gadolinium potassium chromate, 366¹.
 CsHO See *Cesium hydroxide*.
 CsH_2Sn Cesium tin iodide, 3571⁴.
 CsI_2Sn Cesium tin iodide, 3571⁴.
 $\text{Cs}_2\text{Fe}_2\text{Ge}$ Cesium fluogermanate, 2081⁸, 3171⁸.
 $\text{Cs}_2\text{I}_2\text{O}_2\text{Sn}$ Cesium stanniodate, 863⁸.
 $\text{Cs}_2\text{O}_2\text{V}_2$ See *Cesium metavanadate*.
 $\text{Cs}_2\text{O}_2\text{V}_2$ See *Cesium pyrovanadate*.
 CuFeS_2 See *Chalcocopyrite*.
 CuH See *Copper hydride*.
 CuH_2O_2 See *Copper hydroxides*.
 $\text{CuH}_2\text{N}_2\text{O}_2\text{S}$ Ammonium copper sulfate, 3502⁸, 3503^{1, 2}.
 $\text{CuH}_2\text{N}_2\text{O}_2 + 2\text{H}_2\text{O}$, 868⁴.
 $\text{CuH}_2\text{N}_2\text{O}_2\text{S} + 2\text{H}_2\text{O}$, 868⁴.
 $\text{CuH}_2\text{N}_2\text{O}_2\text{S}$, 868⁴.
 CuI See *Copper iodide*.
 $\text{CuK}_2\text{O}_2\text{S}$ Copper potassium sulfate, 3503⁸.
 CuN_2O_2 See *Copper nitrate*.
 CuO See *Copper oxides*.
 $\text{CuO}_2\text{Si} + 0.5\text{H}_2\text{O}$ See *Shalluckite*.
 CuO_2S See *Copper sulfates*.
 $\text{CuO}_2\text{P}_2\text{U}_2$ See *Torbernite*.
 CuPd , 2092².
 CuS See *Copper sulfides*; *Covellite*.
 Cu_2O See *Copper oxides*.
 $\text{Cu}_2\text{O}_2\text{S}$ See *Copper sulfates*.
 Cu_2S See *Chalcocite*; *Copper sulfides*.
 Cu_2Sb See *Copper antimonide*.
 Cu_2Zn_2 , 1619¹, 2655⁸.
 $\text{Cu}_2\text{H}_2\text{O}_2\text{S}$ See *Anilrite*; *Heterobrochantite*.
 Cu_2Pd_2 , 2092².
 Cu_2Sn , 558¹, 2655⁸.
 $\text{Cu}_2\text{H}_2\text{O}_2\text{S}$ See *Brochantite*.
 $\text{Cu}_2\text{O}_2\text{S} + 4\text{H}_2\text{O}$ Copper sulfate (basic), 1069⁸.
 $\text{Cu}_2\text{Fe}_2\text{S}_2$ See *Bornite*.

$Cu_2O_4V_2 + 2H_2O$ See *Turanite*.

Cu_2Te See *Weissite*.

Cu_2Zn_2 , 487.

$Cu_2H_2N_2O_{11}$, 2443⁹.

Er_2O_3 See *Erbium oxide*.

$Eu_2O_3 + 5H_2O$ Europium iodate, 1602⁴.

$Eu_2N_2O_3 + 6H_2O$ Europium nitrate, 1602⁴.

$Eu_2O_3 + 4H_2O$ Europium phosphate, 1602⁴.

•FH See *Hydrofluoric acid*.

FHO_2S Fluorosulfonic acid, P 1553⁸.

FH.N See *Ammonium fluoride*.

FH.NO.S See *Ammonium fluorosulfonate*.

FLi See *Lithium fluoride*.

$FMoO + 3.5H_2O$ Molybdenyl fluoride, 2020⁸.

FNa See *Sodium fluoride*.

F_2HO_2P Difluorophosphoric acid, 3501².

F.H See *Hydrofluoric acid*.

F.Mg See *Magnesium fluoride*.

F.O.S See *Selenium oxyfluoride*.

F.Se See *Selenium fluoride*.

F.Si See *Silicon tetrafluoride*.

F.P See *Phosphorus fluoride*.

F.Go.K, Potassium fluorogermanate, 3171⁸.

F.Go.Li, Lithium fluorogermanate, 3171⁸.

F.Go.Na, Sodium fluorogermanate, 3171⁸.

F.Go.Eb, Rubidium fluorogermanate, 3171⁸.

F.Go.Tl, Thallium fluorogermanate, 3171⁸.

F.H.Si See *Fluoshilic acid*.

F.H.N.Si See *Crysochalcite*.

F.K.Si See *Potassium fluosilicate*.

F.Mg.Si + $6H_2O$, 3500².

F.Na.Si See *Malladrite*; *Sodium fluosilicate*.

F.Si.Zn + $6H_2O$, 3500².

FeO, See *Goethite*.

FeH.O, See *Iron hydroxides*.

FeH.O, See *Iron hydroxides*.

FeH.N.O.S, Ammonium iron sulfate, 2443⁹, 3501⁷, 3502², 3503³.

FeI, See *Iron iodides*.

FeKN.O.S, 869⁴.

FeK.O.S, Iron potassium sulfate, 3502⁴.

FeN.O, See *Iron nitrates*.

FeN.O, See *Iron nitrates*.

FeNa.O, Sodium ferrite, 2535².

FeO See *Iron oxides*.

FeO.Tl See *Ilmenite*.

FeO.P See *Beraunite*.

FeO.S See *Iron sulfates*.

FeS See *Iron sulfides*; *Pyrrhotine*; *Troilite*.

FeS, See *Marcasite*; *Pyrite*.

FeS.Sb, See *Berthierite*.

FeSb See *Iron antimonide*.

FeSe See *Iron selenides*.

FeSi, 2865⁴.

FeSi, 2865⁴.

FeMgO, See *Spinel*.

FeMn.O.Si, See *Calderite*.

FeNa.O.Si, See *Crocidolite*.

FeNa.O, Sodium ferrite, 1524⁸.

Fe.O, See *Hematite*; *Iron oxides*.

Fe.O.Si See *Fayalite*.

Fe.O.S, See *Iron sulfates*.

Fe.S, See *Iron sulfides*.

Fe.W Iron tungstide, 1433⁴.

Fe.KMgO.Si + $3H_2O$ See *Glauconite*.

Fe.O, See *Magnetite*.

Fe.O.P, See *Iron phosphates*; *Vivianite*.

Fe.S, See *Iron sulfides*.

Fe.Sb, Iron antimonide, 3499⁴.

Fe.Si, 1087².

Fe.Si, 2865⁴.

Fe.KN.O.S, 869⁴.

GaH.O, See *Gallium hydroxide*.

GdIO, + $4H_2O$ Gadolinium periodate, 365⁸.

GdLi.O, + $5.5H_2O$ Gadolinium iodate, 365⁸.

GdN.O, + 5 or $6H_2O$ Gadolinium nitrate, 366¹.

GdO.P + $5.5H_2O$ Gadolinium phosphate, 365⁸.

Gd.O.S, + $12H_2O$ Gadolinium sulfite, 365⁸.

Gd.N.O, + $20H_2O$ Gadolinium nitrate, 366¹.

GeH.O, See *Germanium hydroxide*.

GeLi.O, Lithium metagermanate, 1067⁹.

GeLi.O, Lithium orthogermanate, 1067⁹.

GeNa.O, Sodium metagermanate, 1067⁹.

GeNa.O, Sodium orthogermanate, 1067⁹.

Ge.O, See *Germanium oxides*.

Ge.O.Pb + $2H_2O$ Lead metagermanate, 1068¹.

HI See *Hydroiodic acid*.

HIO, See *Iodic acid*.

HIO, See *Periodic acid*.

HLiKO, See *Potassium iodates*.

HLi.K.O.Sn, 865².

HKO See *Potassium hydroxide*.

HKO.S See *Potassium sulfites*.

HLi See *Lithium hydride*.

HLiO See *Lithium hydroxide*.

H.Mn.O, See *Permanganic acid*.

HNO See *Hyponitrous acid*.

HNO, See *Nitrous acid*.

HNO, See *Nitric acid*.

HN, See *Hydrazoic acid*.

HNa See *Sodium hydride*.

HNaO See *Sodium hydroxide*.

HNa.O.S See *Sodium sulfites*.

HNa.O.Si Sodium silicate, 3558⁷.

HNa.S See *Sodium sulfides*.

HNa.O.P See *Sodium phosphates*.

HO.Eb See *Rubidium hydroxide*.

HO.Tl See *Thallium hydroxides*.

HO.P See *Metaphosphoric acid*.

HO.V See *Metavanadic acid*.

HO.V See *Pervanadic acid*.

HO.S.V See *Vanadium sulfates*.

H.HgO, See *Mercury hydroxides*.

HLi.O.Sn Stannic-iodic acid, 865¹.

H.K.O.P See *Potassium phosphates*.

H.K.O.P, See *Potassium pyrophosphates*.

H.MgO, See *Brucite*; *Magnesium hydroxide*.

H.Mn.O, See *Manganese hydroxides*.

H.MgO, See *Molybdc acid*.

H.Mo.O, See *Molybdc acid*.

H.NNa See *Sodium amide*.

H.NO.S Nitrosulfuric acid, 2760².

H.N.O, Nitramide, 690¹.

H.Na.O.P See *Sodium phosphates*.

H.Na.O.P, See *Sodium pyrophosphates*.

H.NiO, See *Nickel hydroxides*.

H.O See *Water*.

H.O, See *Hydrogen peroxide*.

H.O.Pb See *Lead hydroxide*.

H.O.Zn See *Zinc hydroxide*.

H.O.S See *Sulfurous acid*.

H.O.S, See *Thiosulfuric acid*.

H.O.Si See *Silicic acids*.

H.O.Sn See *Tin acids*.

H.O.O, See *Osmic acid*.

H.O.S See *Sulfuric acid*.

H.O.S, See *Hyposulfuric acid*.

H.O.W See *Tungstic acid*.

H.O.Si, See *Silicic acids*.

H.O.S, See *Dithionic acid*.

H.O.S, See *Pyrosulfuric acid*.

H.O.S, See *Persulfuric acid*.

H.S See *Hydrogen sulfide*.

H.Se See *Hydrogen selenide*.

H.FeO, See *Iron hydroxide*.

- H₂Fe₂O₇** See *Limonite*.
H₂O.Tl + 2H₂O, 3571¹.
H₂InO₃ See *Indium hydroxide*.
H₂LaO₃ See *Lanthanum hydroxide*.
H₂Mo₁₀O₂₇P + 4H₂O, 2442².
H₂N See *Ammonia*.
H₂NO See *Hydroxylamine*.
H₂NO₃S See *Sulfamic acid*.
H₂NaO₃S₂ See *Sodium sulfates*.
H₂O.P See *Hypophosphorus acid*.
H₂O₃P See *Phosphorus acid*.
H₂O₃Sc See *Scandium hydroxide*.
H₂O.Tl See *Thallium hydroxide*.
H₂O.P See *Phosphoric acid*.
H₂O.V Orthoperoxovanadic acid, 545⁴.
H.P See *Phosphine*.
H.Sb See *Stibine*.
H.N See *Ammonium iodide*.
H₂N.Pb + 2H₂O Ammonium lead iodide, 1602⁷.
H₂LiO₃Sn Trihydroxy-tri-iodatoantimonic acid, 865³.
H₂LiO₃Sn Dihydroxytetraiodostannic acid, 865¹.
H₂MgN₂ Magnesium amide, 689³, 3170⁷.
H₂NO₃P See *Ammonium metaphosphate*.
H₂NO₃S.V Ammonium vanadium sulfate, 711², 712¹.
H.N See *Hydrazine*.
H₂N₂O₃ See *Ammonium nitrate*.
H₂O.Sn See *Tin acids*.
H₂O.P₂ See *Pyrophosphoric acid*.
H.Si See *Silicon hydrides*.
H₂NO₃S See *Ammonium sulfates*.
H₂O₃S.V₂, 3160⁹.
H₂LiO₃Sn Tetrahydroxy-di-iodato stannic acid, 865².
H₂NO₃P See *Ammonium phosphates*.
H₂N₂O.Pt, 2621¹.
H₂N₂O₃.Si.Zr See *Elpidite*.
H₂N₂O.Pt, 2621¹.
H₂Li₂N₂O₃Sn Ammonium stannic-iodate, 865².
H₂La₂N₂O₃Si + 2H₂O Ammonium lanthanum sulfate, 711².
H₂MgN₂O₃S₂ + 6H₂O Ammonium magnesium sulfate, 3501⁷.
H₂MgN₂.Na₂ Sodium ammonomagnesium, 689³.
H₂MnN₂O₃S₂ Ammonium manganese sulfate, 16³, 3503³.
H₂MoN₂O₃ See *Ammonium molybdate*.
H₂Mo₁₀O₂₇Si Silicomolybdic acid, 2444¹.
H₂Mo₁₀O₂₇ Molybdomolybdic acid, 2444¹.
H₂N₂NiO₃S₂ Ammonium nickel sulfate, 16³, 2419¹, 3503³.
H₂N₂O₃S See *Ammonium sulfates*.
H₂N₂O₃S See *Ammonium sulfates*.
H₂N₂O₃S₂ See *Ammonium persulfate*.
H₂N₂O₃.Zn Ammonium zinc sulfate, 3503³.
H₂N₂O₃S₂U + 2H₂O Ammonium uranyl sulfate, 3529⁷.
H₂N₂O₃S₂U₂ + 5H₂O Ammonium uranyl sulfate, 3529⁷.
H₂N₂O₃.Pt, 2621¹.
H₂BMo₁₀O₂₇ Boromolybdic acid, 2444¹.
H₂Mo₁₀O₂₇P Phosphomolybdic acid, 2444¹.
H₂N₂O.P See *Ammonium phosphates*.
H₂N₂O.Pt, 2621¹.
H₂Li₂N₂O₃.Pt, 2622⁷.
H₂N₂O.P See *Ammonium phosphates*.
H₂N₂O.V See *Ammonium vanadate*.
H₂N₂O₃S + H₂O, 2229⁷.
H₂N₂O.P See *Ammonium phosphates*.
H₂N₂O.Pt, 2620⁹.
H₂N₂O₃.Pt₂S₂, 2622¹.
H₂N₂O₃.Pt₂S₂, 2622¹.
H₂N₂O₃Si₁₀, 1523⁹.
H₂N₂O₃.Pt₂S₂, 2620⁹.
H₂La₂N₂O₃S₂ Ammonium lanthanum sulfate, 711².
H₂Mo₁₀N₂O₂₇Si + 5H₂O, 1839⁹.
H₂N₂O₃.PV₂W₂ + 25H₂O, 542⁸.
H₂N₂O₃.PV₂W₂ + 25H₂O, 542⁸.
H₂N₂O₃.PV₂W₂ + 25H₂O, 542⁸.
H₂Mo₁₀N₂O₂₇Si + 27H₂O, 1039⁷.
H₂Mo₁₀N₂O₂₇Si + 16H₂O, 1939⁷.
H₂O₆Si₁₂U₁₂ See *Soddiite*.
H₂La₂N₂O₃S₂ Ammonium lanthanum sulfate, 711².
H₂Mo₁₀N₂O₂₇Si + 7H₂O Ammonium paramolybdate, 3171⁴.
H₂La₂N₂O₃S₂ Ammonium lanthanum sulfate, 711².
Hf₂O₃P See *Hafnium phosphate*.
HgI₂ See *Mercury iodides*.
HgMnS₂ Manganese mercury sulfide, 1424⁴.
HgN₂O₃ See *Mercury nitrates*.
HgN₂O₃Tl Mercury thallium nitrate, 1781⁴.
HgO See *Mercury oxides*.
HgO₃S See *Mercury sulfates*.
HgS See *Mercury sulfides*; *Metacinnabarite*.
HgS₂Zn Mercury zinc sulfide, 1424⁴.
HgSe See *Mercury selenide*; *Tiemannite*.
HgTe See *Coloradoite*; *Mercury telluride*.
Hg₂N₂O₃ See *Mercury nitrates*.
Ho₂O₃ See *Holmium oxides*.
IK See *Potassium iodide*.
IKO₃ See *Potassium iodate*.
ILi See *Lithium iodide*.
IMg See *Magnesium iodides*.
INa See *Sodium iodide*.
INaO₃ See *Sodium iodate*.
ITl See *Thallium iodide*.
I.K₂O₃ Potassium metaperiodate, 347¹.
I.Mg See *Magnesium iodides*.
I.OZr + 3H₂O, 3571⁸.
I.P See *Phosphorus iodides*.
I.Pb See *Lead iodide*.
I.Ru See *Ruthenium iodide*.
I.Sn See *Tin iodides*.
I.Sr See *Strontium iodide*.
I.Zn See *Zinc iodide*.
IKPb + 2H₂O Lead potassium iodide, 1602⁷.
IN See *Nitrogen iodide*.
INaPb + 2H₂O Lead sodium iodide, 1602⁷.
I.P See *Phosphorus iodides*.
IRb Rubidium triiodide, 3571⁴.
IRbSn Rubidium tin iodide, 3571⁴.
IRb See *Antimony iodide*.
I.Sn See *Tin iodides*.
I.Th See *Thorium iodide*.
I.Ti See *Titanium iodide*.
IRbSn₂ Rubidium tin iodide, 3571⁴.
IK₂O₃Sn Potassium iodostannate, 865².
IK₂Pt Potassium iodoplatinate, 3280⁷.
ILi₂O₃Sn Lithium iodostannate, 865².
INa₂O₃Sn Sodium iodostannate, 865².
IRb₂O₃Sn Rubidium iodostannate, 865².
IRb₂Sn₂, 3571⁴.
KMnO₄ See *Potassium permanganate*.
KNO₃ See *Potassium nitrate*.
KO.UV + H₂O See *Carnotite*.
KO₃S₂V + 12H₂O Potassium vanadium sulfate, 712¹.
K₂MgO₃S₂ + 6H₂O Magnesium potassium sulfate, 3501⁷.
K₂Mo₁₀O₂₇ Potassium tetramolybdate, 2620⁹.
K₂O See *Potassium oxide*.
K₂O₃S See *Potassium sulfate*.

- K₂O₂**: See *Potassium metabisulfite*.
K₂O₃: Potassium trithionate, 865.
K₂O₄: Potassium tetrathionate, 1048.
K₂O₅: Potassium pentathionate, 1048.
K₂O₆: See *Potassium persulfate*.
K₂O₈·2Zn: Potassium zinc sulfate, 3502*, 3503*.
K₂O₈·5U + 2H₂O: Potassium uranyl sulfate, 3520*.
K₂O₈·5U₂ + 5H₂O: Potassium uranyl sulfate, 3520*.
K₂O·P: See *Potassium phosphates*.
K₂O·V: See *Potassium metavanadate*.

La₂O₃: See *Lanthanum oxide*.
LiMnO₄: See *Lithium permanganate*.
Li₂MoO₄: Lithium molybdate, 1428*.
Li₂O: See *Lithium oxide*.
Li₂O₂: See *Lithium sulfate*.
Li₂O·W: Lithium tungstate, 1426*.
Li₂N: See *Lithium nitride*.

MgO: See *Magnesia*.
MgO₂: See *Magnesium sulfite*.
MgO₃: See *Kieserite*; *Magnesium sulfate*.
MgO₄·Zn + 14H₂O: Magnesium zinc sulfate, 1573*.
MgO₄·V₂ + 7H₂O: See *Shadowskite*.
Mg₂O: See *Magnesium sulfite*.
Mg₂Se: See *Magnesium selenide*.
Mg₂Zn: Magnesium zinc silicide, 1384*.
Mg₂O₃·Si: See *Forsterite*.
Mg₂O₄·Zn + 21H₂O: Magnesium zinc sulfate, 1573*.
Mg₂Si: See *Magnesium silicide*.
Mg₂O·P₂: See *Magnesium phosphates*.
MnNaO₄: See *Sodium permanganate*.
 See *Manganese oxides*.
 See *Manganese oxides*.
 (See also *Penwithite*)
Manganese silicate, 2244*.
MnO₂: See *Manganese sulfates*.
MnS: See *Manganese sulfide*.
MnSb: See *Manganese antimonide*.
MnSe: See *Manganese selenide*.
MnTe: Manganese telluride, 3499*.
MnZn₂, 3340*.
MnZn₃, 3340*.
MnZn₄, 3340*.
Mn₂O₃: See *Manganese oxides*.
Mn₂O₄·P₂: Manganese pyrophosphate, 1920*.
Mn₂O₅: See *Manganese oxides*.
Mn₂O₆·Si₂, 2244*.
Mn₂Sb₂: Manganese antimonide, 3499*.
Mn₂O₃·Si₂: See *Blythite*.
MoNa₂O₄: See *Sodium molybdate*.
MoO₃: See *Molybdenum oxides*.
MoO₄·S: Molybdenum sulfate, 1914*.
MoS₂: See *Molybdenite*.
MoS₃: See *Molybdenum sulfide*.
MoSi₂: Molybdenum silicide, 3498*.
Mo₂O₇·P: Molybdenyl phosphate, 2620*.
Mo₂Na₂O₄ + 22H₂O: Sodium paramolybdate, 3171*.

NNaO₂: See *Sodium nitrite*.
NNaO₃: See *Sodium nitrate*.
NNa₂O₂·S + H₂O: Darapskite, 3713*.
 See *Nitrogen oxides*.
 See *Nitrogen oxides*.
NO₂Tl: See *Thallium nitrate*.
NP: See *Phosphorus nitride*.
NSi: Silicon nitride, 1925*.
NSi₂O₃: See *Hydrazinesulfonic acid*.
NSi₂O₄: Sodium hyponitrite, 1602*.

Ni₂NiO₄: See *Nickel nitrate*.
Ni₂O: See *Nitrogen oxides*.
Ni₂O₂: See *Nitrogen oxides*.
Ni₂O₃·Pd: Palladium nitrite, 1068*.
Ni₂O₄: See *Nitrogen oxides*.
Ni₂O₅·Pb: See *Lead nitrate*.
Ni₂O₆·PdS: Addn. compd. of PdSO₄ and NO, 1068*.
Ni₂O₇·U: See *Uranyl nitrate*.
Ni₂Ti₂: See *Titanium nitride*.
Ni₂W: Tungsten nitride, 3573*.
Ni₂Na: See *Sodium azide*.
Ni₂OnTh: See *Thorium nitrate*.
Ni₂OnTi: See *Titanium nitrate*.
Ni₂Ti₂: Titanium nitride, 3170*.
Ni₂Pb: See *Lead azide*.
Na₂O₂·Zn: See *Sodium zincate*.
Na₂O₃·P: See *Sodium metaphosphate*.
Na₂O: See *Sodium oxides*.
Na₂O₂: See *Sodium oxides*.
Na₂O₃·Pb: Sodium plumbite, 3576*.
Na₂O₄·S: See *Sodium sulfites*.
Na₂O₅·S₂: See *Sodium thiosulfate*.
Na₂O₆·Se: See *Sodium selenite*.
Na₂O₇·Si: See *Sodium silicates*.
Na₂O₈·S: See *Sodium sulfates*.
Na₂O₉·S₂: See *Sodium hyposulfite*.
Na₂O₁₀·W: See *Sodium tungstates*.
Na₂O₁₁·S₂: See *Sodium metabisulfite*.
Na₂O₁₂·W₂: See *Sodium tungstates*.
Na₂O₁₃·W₂: See *Sodium tungstates*.
Na₂O₁₄·W₂: See *Sodium tungstates*.
Na₂O₁₅·W₂: See *Sodium tungstates*.
Na₂O₁₆·W₂: See *Sodium tungstates*.
Na₂O₁₇·W₂: See *Sodium tungstates*.
Na₂O₁₈·W₂: See *Sodium tungstates*.
Na₂O₁₉·W₂: See *Sodium tungstates*.
Na₂O₂₀·W₂: See *Sodium tungstates*.
Na₂O₂₁·W₂: See *Sodium tungstates*.
Na₂O₂₂·W₂: See *Sodium tungstates*.
Na₂O₂₃·W₂: See *Sodium tungstates*.
Na₂O₂₄·W₂: See *Sodium tungstates*.
Na₂O₂₅·W₂: See *Sodium tungstates*.
Na₂O₂₆·W₂: See *Sodium tungstates*.
Na₂O₂₇·W₂: See *Sodium tungstates*.
Na₂O₂₈·W₂: See *Sodium tungstates*.
Na₂O₂₉·W₂: See *Sodium tungstates*.
Na₂O₃₀·W₂: See *Sodium tungstates*.
Na₂O₃₁·W₂: See *Sodium tungstates*.
Na₂O₃₂·W₂: See *Sodium tungstates*.
Na₂O₃₃·W₂: See *Sodium tungstates*.
Na₂O₃₄·W₂: See *Sodium tungstates*.
Na₂O₃₅·W₂: See *Sodium tungstates*.
Na₂O₃₆·W₂: See *Sodium tungstates*.
Na₂O₃₇·W₂: See *Sodium tungstates*.
Na₂O₃₈·W₂: See *Sodium tungstates*.
Na₂O₃₉·W₂: See *Sodium tungstates*.
Na₂O₄₀·W₂: See *Sodium tungstates*.
Na₂O₄₁·W₂: See *Sodium tungstates*.
Na₂O₄₂·W₂: See *Sodium tungstates*.
Na₂O₄₃·W₂: See *Sodium tungstates*.
Na₂O₄₄·W₂: See *Sodium tungstates*.
Na₂O₄₅·W₂: See *Sodium tungstates*.
Na₂O₄₆·W₂: See *Sodium tungstates*.
Na₂O₄₇·W₂: See *Sodium tungstates*.
Na₂O₄₈·W₂: See *Sodium tungstates*.
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Na₂O₅₃·W₂: See *Sodium tungstates*.
Na₂O₅₄·W₂: See *Sodium tungstates*.
Na₂O₅₅·W₂: See *Sodium tungstates*.
Na₂O₅₆·W₂: See *Sodium tungstates*.
Na₂O₅₇·W₂: See *Sodium tungstates*.
Na₂O₅₈·W₂: See *Sodium tungstates*.
Na₂O₅₉·W₂: See *Sodium tungstates*.
Na₂O₆₀·W₂: See *Sodium tungstates*.
Na₂O₆₁·W₂: See *Sodium tungstates*.
Na₂O₆₂·W₂: See *Sodium tungstates*.
Na₂O₆₃·W₂: See *Sodium tungstates*.
Na₂O₆₄·W₂: See *Sodium tungstates*.
Na₂O₆₅·W₂: See *Sodium tungstates*.
Na₂O₆₆·W₂: See *Sodium tungstates*.
Na₂O₆₇·W₂: See *Sodium tungstates*.
Na₂O₆₈·W₂: See *Sodium tungstates*.
Na₂O₆₉·W₂: See *Sodium tungstates*.
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Na₂O₇₂·W₂: See *Sodium tungstates*.
Na₂O₇₃·W₂: See *Sodium tungstates*.
Na₂O₇₄·W₂: See *Sodium tungstates*.
Na₂O₇₅·W₂: See *Sodium tungstates*.
Na₂O₇₆·W₂: See *Sodium tungstates*.
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Na₂O₇₉·W₂: See *Sodium tungstates*.
Na₂O₈₀·W₂: See *Sodium tungstates*.
Na₂O₈₁·W₂: See *Sodium tungstates*.
Na₂O₈₂·W₂: See *Sodium tungstates*.
Na₂O₈₃·W₂: See *Sodium tungstates*.
Na₂O₈₄·W₂: See *Sodium tungstates*.
Na₂O₈₅·W₂: See *Sodium tungstates*.
Na₂O₈₆·W₂: See *Sodium tungstates*.
Na₂O₈₇·W₂: See *Sodium tungstates*.
Na₂O₈₈·W₂: See *Sodium tungstates*.
Na₂O₈₉·W₂: See *Sodium tungstates*.
Na₂O₉₀·W₂: See *Sodium tungstates*.
Na₂O₉₁·W₂: See *Sodium tungstates*.
Na₂O₉₂·W₂: See *Sodium tungstates*.
Na₂O₉₃·W₂: See *Sodium tungstates*.
Na₂O₉₄·W₂: See *Sodium tungstates*.
Na₂O₉₅·W₂: See *Sodium tungstates*.
Na₂O₉₆·W₂: See *Sodium tungstates*.
Na₂O₉₇·W₂: See *Sodium tungstates*.
Na₂O₉₈·W₂: See *Sodium tungstates*.
Na₂O₉₉·W₂: See *Sodium tungstates*.
Na₂O₁₀₀·W₂: See *Sodium tungstates*.

OPb: See *Lead oxides*.
OPb₂: See *Lead oxides*.
OSn: See *Tin oxides*.
OSr: See *Strontium oxide*.
OTl₂: See *Thallium oxide*.
OZn: See *Zinc oxide*.
O₂Pb: See *Lead oxides*.
O₂S: See *Sulfur dioxide*.
O₂Se: See *Selenium oxides*.
O₂Si: See *Cristobalite*; *Quartz*; *Silica*; *Tridymite*.
O₂Sn: See *Cassiterite*; *Tin oxides*.
O₂Th: See *Thorium oxide*.
O₂Ti: See *Anatase*; *Rutile*; *Titanium oxides*.
O₂U: See *Uraninite*; *Uranium oxides*.
O₂W: See *Tungsten oxides*.

O₂Zn See *Baddeleyite*; *Zirconium oxide*.
 O₂Pr₂ See *Praseodymium oxides*.
 O₂S See *Sulfur trioxide*.
 O₂Se See *Selenium oxides*.
 O₂U See *Becquerelite*; *Uranium oxides*.
 O₂W See *Tungsten oxides*.
 O₂Y₂ See *Yttrium oxide*.
 O₂Os See *Osmium oxide*.
 O₂PYt See *Xenotime*.
 O₂PbS See *Lead sulfate*.
 O₂Rb₂S See *Rubidium sulfate*.
 O₂Ru See *Ruthenium oxide*.
 O₂SSr See *Celestite*; *Strontium sulfate*.
 O₂STl See *Titanium sulfates*.
 O₂STl₂ See *Thallium sulfate*.
 O₂SLZn See *Zinc sulfate*.
 O₂SLZn₂ See *Willemite*.
 O₂V₂ See *Vanadium oxides*.
 O₂P₂ See *Phosphorus oxides*.
 O₂Pb₂S Addn. compd. of PbO and PbSO₄, 1082^o.
 O₂Sb₂ See *Antimony oxide*.
 O₂SV See *Vanadyl sulfate*.
 O₂Ta₂ See *Tantalum oxides*.
 O₂Tl₂ See *Titanium oxides*.
 O₂V₂ See *Alaite*; *Vanadium oxides*.
 O₂W₂ See *Tungsten oxides*.
 O₂PbSiU + H₂O See *Kasolite*.
 O₂Pb₂S Addn. compd. of PbO and PbSO₄, 1082^o.
 O₂SU Uranyl sulfate, 1409², 3529².
 O₂S₂ Sulfuryl sulfate, 1770⁴.
 O₂W₂ See *Tungsten oxides*.
 O₂Pb₂S Addn. compd. of PbO and PbSO₄, 1082^o.
 O₂Rb₂V₂ See *Rubidium pyrovanadate*.
 O₂Br₂V₂ See *Strontium pyrovanadate*.
 O₂P₂Pb₂ See *Lead phosphate*.
 O₂U₂ See *Uranium oxides*.

O₂Rb₂V₂ See *Rubidium metavanadate*.
 O₂P₂Pb₂U + H₂O. See *Parsonsite*.
 O₂Pr₂ See *Praseodymium oxides*.
 O₂P₂Pb₂U₂ + 3H₂O See *Dewindtite*.
 O₂S₂V₂ See *Vanadium sulfates*.
 O₂S₂V₂ Vanadyl sulfate, 32⁴, 545⁴, 1914⁴.
 O₂W₂ See *Tungsten oxides*.
 O₂P₂Pb₂U₂ + 5H₂O. See *Dumontite*.
 O₂P₂Zr₂ See *Zirconium phosphate*.
 O₂S₂V₂, 545⁴.
 O₂Pb₂V₂ + 4H₂O See *Curite*.

P₂Se, Phosphorus selenide, 214⁴.
 PbS See *Galena*; *Lead sulfides*.
 PbTe Lead telluride, 2655⁴.
 PbTl₂, 2655⁴.

RuS₂ See *Ruthenium sulfides*.

SSi See *Silicon sulfides*.
 SSn See *Tin sulfide*.
 SSR See *Strontium sulfide*.
 SZn See *Sphalerite*; *Zinc sulfide*.
 S₂Se Selenium sulfide, 1770⁴.
 S₂Si See *Silicon sulfides*.
 S₂Sb₂ See *Antimony sulfides*; *Stibnite*.
 S₂Sb₂ See *Antimony sulfides*.
 SbTl Thallium antimonide, 3011⁴.
 SbZn Zinc antimonide, 2655⁴.
 Sb₂Se₂ Antimony selenide, 3011⁴.
 Sb₂Te₂ Antimony telluride, 3055⁴, 3011⁴.
 Sb₂Zn₂ Zinc antimonide, 2655⁴.
 SeZn See *Zinc selenide*.
 Si₂W Tungsten silicide, 3498⁴.
 SnTe Tin telluride, 2655⁴.

TeZn See *Zinc telluride*.

ABBREVIATIONS USED IN CHEMICAL ABSTRACTS

[α] specific rotation	cond. conductivity
($[\alpha]_D^{20}$, for 20° and sodium light)	const. constant
abs. absolute	contg. containing
Ac acetyl (AcH, acetaldehyde; AcOH, acetic acid)	cor. corrected
a. c. alternating current	c. p. candle power
addn. addition	c. P. chemically pure
addnl. additional	crit. critical
alc. alcohol	cryst. crystalline (not crystallize)
alk. alkaline (not alkali)	crystd. crystallized
alky. alkalinity	crystn. crystallization
Am. amyl	cu. m. cubic meter
amp. ampere(s)	d. density (d_{15} , specific gravity at 13° referred to water at 4°; d_{20}^{20} , at 20° referred to water at the same temperature)
amt. amount	d. c. direct current
anhyd. anhydrous	decomn. decomposition
app. apparatus	deriv. derivative
approx. approximate, approximately	det. determine
aq. aqueous	detd. determined
assoc. associate(s)	detg. determining
assocd. associated	detn. determination
associ. association	dil. dilute
at. atomic (not atom)	diln. dilution
atm. atmosphere(s), atmospheric	dissoc. dissociate(s)
at. wt. atomic weight	dissocd. dissociated
av. average (except as a verb)	dissocn. dissociation
b. (followed by a figure denoting temperature) boils at, boiling at (similarly b_{15} , at 15 mm. pressure)	distd. distilled
bacteriol. bacteriological	distg. distilling
b. p. boiling point	distn. distillation
B. t. u. British thermal unit(s)	elec. electric, electrical
Bu butyl (normal)	e. m. f. electromotive force
Bz benzoyl (BzH, benzaldehyde; BzOH, benzoic acid)	equil. equilibrium
cal. calorie(s)	equiv. equivalent
calc. calculate	est. estimate
calcd. calculated	estd. estimated
calcg. calculating	estg. estimating
calcn. calculation	estn. estimation
cc. cubic centimeter(s)	Et ethyl (H_5C_2O , ethyl ether)
c. d. current density	evap. evaporate
chem. chemical (not chemistry)	evapd. evaporated
cm. centimeter(s)	evapg. evaporating
coeff. coefficient	evapn. evaporation
com. commercial	examd. examined
compd. compound	exang. examining
compn. composition	examn. examination
conc. concentrate	expt. experiment
concd. concentrated	exptl. experimental
concn. concentration	ext. extract
	extd. extracted

extg. extracting	parts per million
extn. extraction	precipitate
f. p. freezing point	precipitated
ft. foot, feet	pptg. precipitating
g. gram(s)	pptn. precipitation
h. p. horsepower	Pr propyl
hr. hour	prep. prepare
in. inch(es)	prepd. prepared
inorg. inorganic	prepg. preparing
insol. insoluble	prepn. preparation
kg. kilogram(s)	qual. qualitative
kw. kilowatt(s)	quant. quantitative
l. liter(s)	recrystd. recrystallized
lab. laboratory	resp. respectively
pound(s)	r. p. m. revolutions per minute
m. meter(s); also (followed by a figure denoting temperature) melts at, melt- ing at	sapon. saponification
manuf. manufacture	sapond. saponified
math. mathematical	sapong. saponifying
max. maximum	sat. saturate
Me methyl (MeOH, methanol)	satd. saturate
mech. mechanical	satg. saturation
mfg. manufacturing	satn. saturation
mg. milligram	sec. second(s)
min. minimum (also minute(s))	sep. separate
mixt. mixture	sepd. separated
mol. molecule, molecular	sepg. separating
mol. wt. molecular weight	sepn. separation
m. p. melting point	sol. soluble
n index of refraction (n_D^{20} , for 20° and sodium light)	soln. solution
N normal	soly. solubility
neg. negative	sp. specific
no. number	sp. gr. specific gravity
org. organic	sq. cm. square centimeter(s)
p. d. potential difference	sym. symmetrical
pharmacol. pharmacological	temp. temperature
phys. physical	U. S. P. United States Pharmacopeia
physiol. physiological	v. volt(s)
pos. positive	vol. volume (not volatile)
powd. powdered	w. watt(s)
	w. p. c. watts per candle
	wt. weight

